These documents are a minimum requirement for the control.
**SINUMERIK® Documentation**

**Printing history**

Brief details of this edition and previous editions are listed below.

The status of each edition is shown by the code in the “Remarks” column.

**Status code in the “Remarks” column:**

A . . . . New documentation.
B . . . . Unrevised reprint with new Order No.
C . . . . Revised edition with new status.

If factual changes have been made on the page in relation to the same software version, this is indicated by a new edition coding in the header on that page.

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This manual is included in the documentation on CD-ROM *(DOCONCD)*

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Preface

Notes for the reader

Structure of the documentation
The SIMODRIVE 611/SINUMERIK 840D documentation is organized on 3 levels:
- General Documentation
- User Documentation
- Manufacturer/Service Documentation

The description of functions for the ANA-module belongs to the SIMODRIVE/SINUMERIK documentation.

For further information about publications included in the documentation overview and other available SIMODRIVE/SINUMERIK documents, please contact your local Siemens sales office.

This publication does not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

The contents of this publication shall neither become part of nor modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligations of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

Target group
This document is intended for machine manufacturers and service personnel who use or service “ANA modules”.

Should you require further information or should any problems arise that are not described in detail in this publication, please contact your local Siemens sales office.

How to find information in this description
The following guides are provided to help you access information faster:
- General table of contents
- Header (as orientation guide):
  - The header on the top line contains the main section number
  - The header on the second line contains the subsection number
- Appendix containing
  - Abbreviations, Terms and List of References
  - Glossary (Index)

If you require information about a particular term or subject, please refer to the glossary for the page number on which the relevant information can be found.
**Definition:**

**Who are qualified personnel?**

For the purpose of this description and product labels, a “qualified person” is one who is familiar with this installation, mounting, start-up and operation of the product and the hazards involved. He or she must have the following qualifications:

- Trained and authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety practices.
- Trained in the proper care and use of protective equipment in accordance with established safety practices.
- Trained in rendering first aid.

**Software versions**

The SW versions specified in this documentation refer to the SINUMERIK 840D control system.

The Description of Functions applies only to the software versions specified. When a new software version is released, the Description of Functions for that version must be ordered.

---

**Important**

This documentation applies to:

- SINUMERIK 840D control system and SIMODRIVE 611 digital drive, software version 5
Explanation of symbols

Important
This symbol always appears in the documentation when important information is being conveyed.

Ordering data option
In this documentation, you will find this symbol with a reference to an ordering option. The function described is executable only if the control contains the designated option.

Machine manufacturer
This symbol appears in this documentation whenever the machine manufacturer can influence or modify the described functional behavior. Please observe the information provided by the machine manufacturer.

Danger
This symbol appears whenever death, severe physical injury or substantial material damage will occur if the appropriate precautions are not taken.

Caution
This symbol appears whenever minor physical injury or material damage can occur if the appropriate precautions are not taken.

Warning
This symbol appears whenever death, severe physical injury or substantial material damage can occur if the appropriate precautions are not taken.
Technical information

Warning
Operational electrical equipment has parts and components which are at hazardous voltage levels.

Incorrect handling of this units, i.e. failure to observe the warning information, can therefore result in severe bodily injury or property damage.

Only appropriately qualified personnel may start up this equipment.

This personnel must have in-depth knowledge regarding all the warning information and service instructions contained in this Guide.

Perfect and safe operation of this equipment assumes professional transport, storage, mounting and installation as well as careful operator control and servicing.

Hazardous axis movements can occur while you are working on the equipment.

Note
When installing cables, please observe the following:

- They must not be damaged.
- The must not be stressed.
- They must not be come into contact with rotating components.

Warning
When voltage tests are performed on installed electrical equipment of machinery, all connections of the SIMODRIVE drive must be disconnected (EN 60204-1 (VDE0113-1), Pkt. 20.4).

This measure must be taken so as to avoid further stressing insulation of the SIMODRIVE equipment.

Warning
Start-up is absolutely prohibited until it has been ensured that the machine, in which the components described here are to be installed, fulfills the specification of Machinery Directive 89/392/EEC.
Warning

The information and instructions in all the documentation supplied and any other instructions must always be observed to eliminate the risk of hazards and equipment damage.

- The information given in catalogs and quotations applies additionally to special versions of machines and equipment.
- Furthermore, all relevant national, local and plant-specific regulations and specifications must also be taken into account.
- All work must be undertaken with the system in a no-voltage condition (powered down!)

Instructions for ESD-sensitive components

Components sensitive to ElectroStatic Discharge

Components which can be destroyed by electrostatic discharge are individual components, integrated circuits or boards which, when handled, tested or transported, could be destroyed by electrostatic fields or electrostatic discharge. These components are designated as ESDS (ElectroStatic Discharge Sensitive Devices).

Handling ESDS boards:

- When handling components which can be destroyed by electrostatic discharge, it must be ensured that personnel, the workstation and packaging are well grounded.
- As a general rule, electronic boards should only be touched when absolutely necessary.
- You may only touch ESDS components if
  - you are continuously grounded via an ESDS bracelet,
  - you are wearing ESDS shoes or ESDS shoud grounding strips in conjunction with an ESDS floor surface.
- Boards may only be placed on conductive surfaces (desk with ESDS surface, conductive ESDS foam rubber, ESDS packing bag, ESDS transport containers).
- Boards may not be brought close to data terminals, monitors or television sets (a minimum of 10 cm should be kept between the board and the screen).
- Boards may not be brought into contact with materials which can be charged and are high insulating, e.g. plastic foils, insulating desktops, articles of clothing manufactures from man-made fibers.
- Measurements may be taken on the boards only if
  - the measuring equipment is grounded (e.g. via the protective conductor) or
  - in the case of floating measuring instruments, the probe is briefly discharged before a measurement is taken (e.g. through contact with bare control housing).
- Closed-loop control boards, option modules and memory modules may only be held by the front plate or at the edges.
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General

1.1 Application

The ANA control is based on an HLA closed-loop control module. By appropriately configuring the drive communication bus, it is possible to operate up to two analog axes using the closed-loop control module.

Plugged into the 50 mm (1.97 in) wide universal basic housing, the unit acts as a control module which allows the operation of external drives with analog speed set-point interface of ± 10 V at the SINUMERIK 840D control via the digital drive bus. In the following, this is referred to as the ANA module.

The standard two-axis closed-loop control module can be configured either for two analog axes or for mixed operation for one analog ANA axis and one hydraulic HLA axis.

The function of an analog ANA axis mainly consists of the conversion of the digital to an analog ± 10 V speed set-point and of the conditioning of the actual position value for communication via the drive bus.

This allows external drives to be integrated as interpolating path axes or main spindles into the digital drive combination.

Straight functions of the digital drive control SIMODRIVE 611 are naturally not possible for external drive units coupled via analog speed set-point interfaces. (These are functions which are dependent upon feedback within the axis and communication by means of the drive bus, e.g. Safety Integrated or system-relevant start-up aids). Where necessary, separate EMC measures should also be taken in respect of the external drive units.

The SINUMERIK 840D system offers a range of NCU modules with scaled functionality to meet the different needs and requirements. This allows optimum adaptation to the individual machine and the machining tasks as well as equipping entire machine sets.
1.2 Configuration of an analog controlled drive axis

1.2.1 Overview

The SINUMERIK controls and SIMODRIVE drive systems are specifically designed for machine tools, manipulators and special machines.

The numerical control processes the machine program, converts it into control commands and continuously monitors execution of commands.

The ANA module represents the interface between the SINUMERIK 840D and an analog drive amplifier.

1.2.2 SINUMERIK 840D/SIMODRIVE 611 digital

The SINUMERIK controls and SIMODRIVE drive systems are specifically designed for machine tools, manipulators and special machines.

The numerical control processes the machine program, converts it into control commands and continuously monitors execution of commands.

The ANA module represents the interface between the SINUMERIK 840D and an analog drive amplifier.

1.2.3 Required FW packages

- SINUMERIK 840D NCK software ≥ 5.2 incl. SIMODRIVE 611 digital ANA module ≥ HLA 1.01.10
- SINUMERIK 840D MMC software > 5.1

1.2.4 Hardware requirements

- MMC 103
- NCU 561.2, 571.2, 572.2, 573.2
Configuration

2.1 Configuration

Note
For information on configuring and detailed ordering information, please refer to Catalogs NC 60.1 and NC Z.

2.2 Integration in SINUMERIK 840D/SIMODRIVE 611 digital

2.2.1 System overview

Components
A complete 840D control with ANA module consists of various individual components. The table below provides an overview of the components.

<table>
<thead>
<tr>
<th>No.</th>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>NCU box</td>
<td>• Housing for NC-CPU</td>
</tr>
<tr>
<td>B</td>
<td>NC-CPU</td>
<td>• Central processing unit for 840D,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Execution of the NC program,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Contains modules with e.g. PLC/communication function</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fan module for NCU 573.2</td>
</tr>
<tr>
<td>B1</td>
<td>Cable distributor</td>
<td>• Can be connected to NCU</td>
</tr>
<tr>
<td>C1</td>
<td>Operator panel</td>
<td>• Display, keyboard, power supply and operation of NC</td>
</tr>
<tr>
<td>D1</td>
<td>MMC module</td>
<td>• Operator panel calculator (is integrated in operator panel),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MMC 103 with hard disk</td>
</tr>
<tr>
<td>E</td>
<td>Mains supply (MS)</td>
<td>References: /PJ1/ SIMODRIVE 611</td>
</tr>
<tr>
<td>F1</td>
<td>Machine control panel</td>
<td>• Machine operation</td>
</tr>
<tr>
<td>G1</td>
<td>ISA adapter</td>
<td>• Allows operation of AT modules together with MMC module MMC 103 (is integrated in operator panel)</td>
</tr>
<tr>
<td>G2</td>
<td>Full CNC keyboard</td>
<td>• Full keyboard can be connected to MMC module</td>
</tr>
</tbody>
</table>
## 2.2 Integration in SINUMERIK 840D/SIMODRIVE 611 digital

### Table 2-1 Components for 840D with ANA module (number, component, description)

<table>
<thead>
<tr>
<th>No.</th>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3</td>
<td>Memory card (PCMCIA)</td>
<td>• Contains the system program,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Can be plugged into NCU 561.2, 571.2, 572.2, 573.2</td>
</tr>
<tr>
<td>G4</td>
<td>Disk device (accessories)</td>
<td>• Rack-mounting unit for connection to MMC module</td>
</tr>
<tr>
<td>H1  to H9</td>
<td>Cable</td>
<td>Reference: /Z/, Accessories Catalog NC Z</td>
</tr>
<tr>
<td>H10 to H12</td>
<td>Cable</td>
<td>See Section 7, I/Os, accessories</td>
</tr>
<tr>
<td>I</td>
<td>ANA module</td>
<td>• Analog set-point ± 10 V</td>
</tr>
<tr>
<td></td>
<td>50 mm housing module (universal basic housing)</td>
<td>• For housing the ANA closed-loop control plug-in unit (see Fig. 2-4)</td>
</tr>
<tr>
<td>I1</td>
<td>Phoenix cable connection</td>
<td>• 24 V switching</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 24 V external supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• BERO input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• “Pulse enable”</td>
</tr>
<tr>
<td>J</td>
<td>SIMATIC components</td>
<td>Reference: /S7H/, Manual</td>
</tr>
<tr>
<td>K</td>
<td>Terminator</td>
<td>Terminator drive bus (connected to last module in drive group)</td>
</tr>
<tr>
<td>L1</td>
<td>Handheld unit</td>
<td>• Connect HHU to K bus via MPI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Handwheel emergency stop button, keyswitches, override, enable keys, display, unassigned keys</td>
</tr>
<tr>
<td>M1</td>
<td>Distributor box</td>
<td>• For connection of the handheld unit to the MPI bus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Connection for emergency stop circuit, enabling, handwheel, 24 V DC</td>
</tr>
<tr>
<td>N</td>
<td>Cable distributor</td>
<td>• 24 V supply for connection to MPI connector</td>
</tr>
<tr>
<td>O</td>
<td>Analog axis</td>
<td>• Analog feed axis and spindles</td>
</tr>
<tr>
<td>P</td>
<td>External 24 V supply; only necessary when external components are to be supplied via the terminals of the ANA module.</td>
<td>• Stabilized power supply module SITOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reference: Catalog SITOP power</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Order no. E80001-V0752-A253</td>
</tr>
</tbody>
</table>

1) These components are described in:
   **References:** /BH/, Operator Components Manual

### Note

Operating an ANA module just with a SIMODRIVE monitoring module is not permissible; i.e. there must always be a mains infeed module.

For operation of additional SIMODRIVE monitoring modules when using multiple ANA modules, please refer to Planning Guide SIMODRIVE 611 (/PJ1/).

With multi-tier configurations, all infeed units must be connected to the system at the same time.
2.2 Integration in SINUMERIK 840D/SIMODRIVE 611 digital

Fig. 2-1  System components

External 24 V supply; (only necessary when external components are to be supplied via the terminals of the ANA module).

Note: Representation for an analog axis

Enable BERO inputs

Analog drive amplifier

Position acquisition

Analog sensors 0...10 V

Handwheel (2x) (1x of M)

Plug-in battery and fan

Digital I/O (fast NC I/O)

Measurement (2x)

Device bus

SITOP power (external PS)

Floppy disk drive

MMC CPU

 NCU

AN Module

External components. (only necessary when external components are to be supplied via the terminals of the ANA module).
2.3 System framework

Power supply

SINUMERIK 840D and ANA module are supplied by the SIMODRIVE mains supply or by the SIMODRIVE monitoring module (only permissible as power supply expansion for an installed MS module) via the device bus. Any other type of voltage supply is not advisable and can cause damage to the device.

Note

Operating an ANA module just with a SIMODRIVE monitoring module is not permissible!

The power for electrical axes connected in series is supplied via the DC link busbars (40 mm²) of the subrack module.

For more information about the electrical connection conditions of the MS module and monitoring module, as well as advice on circuits, technical data and setting options, please refer to Chapter 2 and References: /PJ2/ SIMODRIVE Planning Guide

---

Fig. 2-2 Design of components for analog axes
**ANA closed-loop control plug-in unit**

![Diagram of ANA closed-loop control plug-in unit](image)

- **Measuring system (encoder connection)**
- **Axis 1**
- **Axis 2**
- **Sensor detection**
- **External drive amplifier**
- **Drive bus**
- **Device bus**

**Fig. 2-3**  ANA closed-loop control plug-in unit (2-axis)

---

1) required only if external 26.5 V is not electrically separated safely
Mounting ANA closed-loop control plug-in unit

**Mounting module**
50 mm (universal basic housing)
(6SN1162-1AA00-0AA0)

**ANA closed-loop control plug-in unit**
(6SN1115-0BA11-0AA0)

- Slotted head screw M3 / 0.8 Nm
- Order no.
- Rating plate/order no.
- Shield support
- Mounting module
- Slotted head screw M3 / 0.8 Nm
- Slotted head screw M5 / 3.0 Nm
- M4 / 1.8 Nm
- M600
- P600

*Fig. 2-4* Mounting ANA closed-loop control plug-in unit in 50 mm housing module (universal basic housing)
### Mains infeed

<table>
<thead>
<tr>
<th>Description</th>
<th>Pin(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact assembly message ready</td>
<td>74</td>
</tr>
<tr>
<td>NC contact</td>
<td>73.1</td>
</tr>
<tr>
<td>NO contact</td>
<td>73.2</td>
</tr>
<tr>
<td>Contact assembly group message R and motor overtemperature</td>
<td>5.3</td>
</tr>
<tr>
<td>Pulse enable</td>
<td>63</td>
</tr>
<tr>
<td>Enable voltage</td>
<td>9</td>
</tr>
<tr>
<td>Enable voltage reference potential</td>
<td>64</td>
</tr>
<tr>
<td>Drive enable</td>
<td>19</td>
</tr>
<tr>
<td>Enable voltage reference potential</td>
<td>9</td>
</tr>
<tr>
<td>Setup mode</td>
<td>48</td>
</tr>
<tr>
<td>Contactor activation, start</td>
<td>213</td>
</tr>
<tr>
<td>Signaling contact from mains contact</td>
<td>112</td>
</tr>
<tr>
<td>Enable for internal mains contact</td>
<td>111</td>
</tr>
<tr>
<td>Signaling contact starting lockout (NC contact)</td>
<td>213</td>
</tr>
<tr>
<td>Enable for internal mains contact</td>
<td>112</td>
</tr>
<tr>
<td>DC link power supply for mains buffering</td>
<td>M500</td>
</tr>
<tr>
<td>External supply for electronics power supply</td>
<td>P500</td>
</tr>
<tr>
<td>External supply for electronics power supply</td>
<td>2U1</td>
</tr>
<tr>
<td>External supply for electronics power supply</td>
<td>1U1</td>
</tr>
<tr>
<td>External supply for electronics power supply</td>
<td>2V1</td>
</tr>
<tr>
<td>External supply for electronics power supply</td>
<td>1V1</td>
</tr>
<tr>
<td>External supply for electronics power supply</td>
<td>2W1</td>
</tr>
<tr>
<td>External supply for electronics power supply</td>
<td>1W1</td>
</tr>
<tr>
<td>Power supply electronics faulty</td>
<td></td>
</tr>
<tr>
<td>Device not ready to operate, enable (T. 63, 64 or 48) missing</td>
<td></td>
</tr>
<tr>
<td>Power fault</td>
<td></td>
</tr>
<tr>
<td>5V voltage level faulty</td>
<td></td>
</tr>
<tr>
<td>Device ready (DC link preloaded)</td>
<td></td>
</tr>
<tr>
<td>Overvoltage DC link</td>
<td></td>
</tr>
<tr>
<td>1) Factory settings with jumpers inserted</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2-5  MS module interfaces (OI and I/RF modules)
2.4 Interconnection

2.4.1 Internal power supply

Important information

Note
The NC CPU is supplied by the SIMODRIVE power supply via the device bus. Any other type of voltage supply is not advisable and can cause damage to the device.

NCU connected load and power dissipation calculation

The ANA module is integrated into the group of SIMODRIVE modules (power supply/infeed module, feed module if required and/or main spindle module) and 840D as a single module. Power is supplied via the device bus.

It is necessary to calculate the gross power requirements for the entire module group. It must not exceed the power provided by the power supply module.

Each module has a weighting factor to facilitate the calculation.

Please refer to Chapter 9 in the following reference manuals for more information about the weighting factor:

References: /NC60.1/, Catalog SINUMERIK & SIMODRIVE

The total of the electronic/control points must not be greater than specified in the power supply data sheet.

2.4.2 External power supply

Requirements for external 26.5 V supply

It is only necessary to connect an external power supply if external components are to be supplied with switched or constant 24 V voltage via the terminals of the ANA module (see Fig. 2-6).

In principle, it is possible to use stabilized or non-stabilized power supplies and switched-mode or linear power supplies.

However, the following must be taken into account:

- If terminals PV1/MV1 or PV2/MV2 are used, then the voltage must correspond to 26.5 V ± 2%. The required voltage tolerance can practically only be achieved with regulation and preferably in switched mode with the existing currents. The ripple when using a non-stabilized power supply may activate the lower monitoring threshold.

- The ANA closed-loop control modules have 24000 µF input capacity per module, that can be best be charged with a stabilized power supply (with current limiting).

- If it is necessary to connect the external 26.5 V supply, external "precharging" (e.g. relay with timer and resistor) should be used.
### Caution
Terminal X431 must not be connected or switched after the external 24 V power supply has been powered on, as the high charging currents can cause considerable damage to the module or the external switch.

### Warning
- The DC supply must have secure electrical insulation.
  See also
  **References**: /PHD/, Configuring NCU 561.2-573.2
- The DC current supply must be connected to the electronic ground of the control at one location (e.g. X131 on I/RF module). In general, this connection has already been made as standard in the S7-300 I/Os. See also
  **References**: /EMC/, SINUMERIK, SIROTEC, SIMODRIVE, EMC
  Installation guideline

### Recommended PS
It is advisable to use the 26.5 V SITOP power external supply range from SIEMENS.

**References**: Catalog, SITOP Power from 2 to 40 A
Order no. E800001-V0752-A253

- **SITOP power supply**
The SITOP power supply types listed in the following table are recommended (24 V DC/10 A; 20 A; 30 A, 40 A three-phase):

<table>
<thead>
<tr>
<th>Input Voltage range</th>
<th>Output Voltage range</th>
<th>Current Io rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 AC 400 V to 500 V</td>
<td>3 AC 360 V to 550 V</td>
<td>10 A 6EP1 434 – 2BA00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 A 6EP1 436 – 2BA00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 A 6EP1 437 – 2BA00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 A 6EP1 437 – 2BA10</td>
</tr>
</tbody>
</table>

- **SITOP power for DC link connection**
  (available soon)
2.4 Interconnection

Fig. 2-6 Connection of external power supply, internal processing in ANA module
2.4.3 Grounding concept/electromagnetic compatibility (EMC)

The 840D system with ANA module consists of several individual components. The individual components are:

- Mains infeed module I/RF
- NCU box
- ANA module
- Machine control panel MCP
- Qwerty keyboard
- Operator panel components (various monitors with different MMC CPUs)
- Terminal box (NCU and L2-DP)
- Distributor box and handheld unit

The individual modules are screwed to the metal cabinet side. In the area where the screws are attached, there may be a low impedance contact between the NCU box and the side of the cabinet. If possible, avoid the use of insulating varnishes.

The electronic groundings of the modules are connected to one another via the device and drive bus and at the same time directed to Terminal X131 on the I/RF module.

The internal electronic ground of the ANA module is directly connected with the metal front plate (of the module).

---

**Fig. 2-7** Grounding concept

With regard to electromagnetic compatibility, please refer to the following:

**References:** /EMC/, EMC Installation Guideline

Standards for declaration of conformity (appendix C)
2.4.4 System integration

Overview of system integration

The following figure shows how the ANA module is primarily integrated between the control and the analog drive\(^1\). The main functions of the ANA module consist of processing the system signal and conversion of the digital speed set-point to an analog ± 10 V signal.

---

**Function**

Analog axes can be used for the same application fields as digital axes. There are no restrictions. The axes are not dependent upon channels, that is, the analog axes can be in different channels and axes can be swapped between channels. All the standard NC axes/spindle functions are available for analog axes, such as:

- Programming from part programs
- Traversing from PLC
- Manual traversing, etc.

**Speed set-point**

Speed set-points for two different analog drive amplifiers can be picked up from the ANA module's terminals (X121, X122).

**Actual value**

The ANA module offers one measuring system input for each axis (X101, X102). A position measuring system is not necessary with axes/spindles that are not position-controlled.

---

1) External drive is to be treated separately with regards to configuration, start-up and EMC.
Servo enable

When issuing the servo enable for the analog drive, the speed control loop of the axis/spindle is closed. With a position-controlled axis/spindle, the servo loop must be closed at the same time.

Setting and cancellation of the servo enable for the analog drive can be performed from the following:

1. Via the PLC user program with an interface signal from the SIMATIC I/O.
2. Via the terminals of the ANA module.

Fig. 2-9 Servo enable via terminals on the ANA module
Sensor actuation, enable logic

The voltage supplied to terminals P24/M24 (X431.5/.6) can be used for different purposes on the terminals of the ANA module (see Fig. 2-6):

1. Terminal P24EXT (X111.1 to X111.2 and X112.1 to X112.2)
   Terminal M24EXT (X111.5/.9/.10/.13 and X112.5/.9/.10/.13)
   The supplied current is carried via electronic current limiting, the entire charge must be max. 200 mA.

2. Terminal P24V1 and P24V2 (X121.1 to X121.4 and X122.1 to X122.4)
   Terminal M24EXT (X121.9 to X121.11 and X122.9 to X121.11)
   The supplied voltage is switched through to these terminals if:
   - The ANA closed-loop control module is ready,
   - Enable (T. 663) is present on the ANA module,
   - Enables (T. 63, T. 64, T. 48) are present on the MS module,
   - NC enable is present.
   Terminals P24V1/V2 are protected against short circuits with fuses.

3. Terminal PV1 and PV2 (X431.2 and X432.2)
   Terminal MV1 and MV2 (X431.3 and X432.4)
   The supplied voltage is switched through to these terminals if:
   - The voltage is 26.5 V ±2% (ripple 240 mVpp),
   - The ANA closed-loop control module is ready,
   - Enable (T. 663) is present on the ANA module,
   - Enables (T. 63, T. 64, T. 48) are present on the MS module,
   - NC enable is present.
3.1 Start-up overview

The menus displays for start-up are provided by the SINUMERIK 840D control system.

How to display these menus is described in:

References: /IAD/, Installation Guide

Machine configuration

The analog axis (ANA) is offered in addition to the electrical drives (SRM, ARM and SLM) as shown below in the “Machine configuration” screen (basic display for start-up):

![Machine configuration screen](image)

Fig. 3-1 Machine configuration (basic display for start-up)
3.2 Configuration

It is necessary to configure the drive bus before the drives can be started up. To do this, press the softkey “Drive configuration”.

![Menu display “Drive configuration”](image)

The selected drive type (here analog drive) is stored in NC machine data MD 13040: DRIVE_TYPE.

<table>
<thead>
<tr>
<th>Table 3-1 Abbreviations for drive types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drive</strong></td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>SRM (FDD)</td>
</tr>
<tr>
<td>ARM (MSD)</td>
</tr>
<tr>
<td>SLM</td>
</tr>
<tr>
<td>HLD</td>
</tr>
<tr>
<td>ANA</td>
</tr>
<tr>
<td>PER</td>
</tr>
</tbody>
</table>
3.3 Set-point

**Set-point configuration**

When using the ANA module, analog axes are treated like digital axes.

<table>
<thead>
<tr>
<th>30100</th>
<th>CTRLOUT_SEGMENT_NR [n]: 0...0</th>
<th>Cross ref.: –</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit:</td>
<td>–</td>
<td>Relevant: Power On</td>
</tr>
<tr>
<td>Standard:</td>
<td>1</td>
<td>Protection level: 2/7</td>
</tr>
<tr>
<td>Minimum:</td>
<td>0</td>
<td>Data type: BYTE</td>
</tr>
<tr>
<td>Maximum:</td>
<td>1</td>
<td>Effectiveness: Power On</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>30110</th>
<th>CTRLOUT_MODULE_NR [n]: 0...0</th>
<th>Cross ref.: –</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit:</td>
<td>–</td>
<td>Relevant: Power On</td>
</tr>
<tr>
<td>Standard:</td>
<td>1</td>
<td>Protection level: 2/7</td>
</tr>
<tr>
<td>Minimum:</td>
<td>1</td>
<td>Data type: BYTE</td>
</tr>
<tr>
<td>Maximum:</td>
<td>31</td>
<td>Effectiveness: Power On</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>30120</th>
<th>CTRLOUT_NR [n]: 0...0</th>
<th>Cross ref.: –</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit:</td>
<td>–</td>
<td>Relevant: Power On</td>
</tr>
<tr>
<td>Standard:</td>
<td>1</td>
<td>Protection level: 2/7</td>
</tr>
<tr>
<td>Minimum:</td>
<td>1</td>
<td>Data type: BYTE</td>
</tr>
<tr>
<td>Maximum:</td>
<td>3</td>
<td>Effectiveness: Power On</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>30130</th>
<th>CTRLOUT_TYPE [n]: 0...0</th>
<th>Cross ref.: –</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit:</td>
<td>–</td>
<td>Relevant: Power On</td>
</tr>
<tr>
<td>Standard:</td>
<td>1</td>
<td>Protection level: 2/7</td>
</tr>
<tr>
<td>Minimum:</td>
<td>0</td>
<td>Data type: BYTE</td>
</tr>
<tr>
<td>Maximum:</td>
<td>3</td>
<td>Effectiveness: Power On</td>
</tr>
</tbody>
</table>

MD 30100: CTRLOUT_SEGMENT_NR = 1 Bus segment 840D
MD 30110: CTRLOUT_MODULE_NR = Must be the module number of a module that is not yet assigned.
MD 30120: CTRLOUT_NR = 1 Always 1 for 840D
MD 30130: CTRLOUT_TYPE = 1 Set-point transfer to 611D

**Standardize set-point**

<table>
<thead>
<tr>
<th>32250</th>
<th>RATED_OUTVAL [n]: 0...0</th>
<th>Cross ref.: –</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit:</td>
<td>–</td>
<td>Relevant: Power On</td>
</tr>
<tr>
<td>Standard:</td>
<td>80.0</td>
<td>Protection level: 0/0</td>
</tr>
<tr>
<td>Minimum:</td>
<td>0.0</td>
<td>Data type: DOUBLE</td>
</tr>
<tr>
<td>Maximum:</td>
<td>Plus</td>
<td>Effectiveness: NEW CONF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>32260</th>
<th>RATED_VELO [n]: 0...0</th>
<th>Cross ref.: –</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit:</td>
<td>–</td>
<td>Relevant: Power level: 1/1</td>
</tr>
<tr>
<td>Standard:</td>
<td>3000</td>
<td>Data type: DOUBLE</td>
</tr>
<tr>
<td>Minimum:</td>
<td>0.0</td>
<td>Effectiveness: NEW CONF</td>
</tr>
<tr>
<td>Maximum:</td>
<td>Plus</td>
<td></td>
</tr>
</tbody>
</table>
The axial machine data MD 32250: RATED_OUTVAL and MD 32260: RATED VELO are for standardizing and limiting the output voltage. The maximum motor speed is specified in rpm in MD 32260. The percent value in MD 32250 indicates the voltage at maximum motor speed in relation to +/- 10 V. The entry 80% with maximum motor speed +/- 8 V on the ANA module. The percent value must be adapted to the analog drive amplifier used.

**Example:**
- Maximum motor speed 6000 rpm MD 32260: RATED VELO = 6000
- 8 V with motor speed 6000 rpm MD 32250: RATED_OUTVAL = 80

With motor speed 3000 rpm, 4 V are applied on the ANA module.

### Drift compensation

<table>
<thead>
<tr>
<th>36700 DRIFT_ENABLE</th>
<th>Cross ref.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic drift compensation</td>
<td>Relevant: Protection level: 2/7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit: –</th>
<th>Standard: 0</th>
<th>Minimum: ***</th>
<th>Maximum: ***</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>36710 DRIFT_LIMIT [n]: 0...0</th>
<th>Cross ref.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation limit value for automatic drift compensation</td>
<td>Relevant: Protection level: 2/7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit: %</th>
<th>Standard: 1</th>
<th>Minimum: 0.0</th>
<th>Maximum: Plus</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>36720 DRIFT_VALUE [n]: 0...0</th>
<th>Cross ref.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic drift value</td>
<td>Relevant: Protection level: 1/1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit: %</th>
<th>Standard: 0.0</th>
<th>Minimum: -5.0</th>
<th>Maximum: 5.0</th>
</tr>
</thead>
</table>

There is a drift in each analog drive which has to be compensated by the position controller. The function "analog axis" offers two different compensations for the drift. One compensation consists of a constant drift value that is entered in MD 36720: DRIFT_VALUE. In each position controller cycle this value is added to the set-point of the position controller and output.

The second compensation is automatic drift compensation. It is activated via machine data MD 36700: DRIFT_ENABLE = 1. A maximum drift value is specified in for the automatic compensation MD 36710: DRIFT_LIMIT. As soon as the analog axis is in control, there are no set-points present from the interpolator and the axis has stopped moving, the drift is automatically compensated. If the axis is traversed again, the last compensation value is frozen and added to the set-point in each position controller cycle. If the compensation value is greater than the value specified in MD 36710: DRIFT_LIMIT, alarm 75110 "Axis X1 has reached drift limit" is set and the drift value is limited.
3.4 Actual value

**Actual value of hardware**

The position actual value of the analog axis is acquired via a signal generator. Connector X101/X102 is used as measured value input.

The ANA module is designed for evaluation of

- **Incremental measuring system** with sinusoidal signals (A, B) and a reference signal (R)

  or

- **Absolute measuring system** with sinusoidal signals (A, B) and EnDat interface for absolute position sensing

(see Section 6.1).

### 30200 NUM_ENCS

<table>
<thead>
<tr>
<th>Number of encoders</th>
<th>Relevant:</th>
<th>Protection level:</th>
<th>Unit:</th>
<th>Standard:</th>
<th>Minimum:</th>
<th>Maximum:</th>
<th>Data type:</th>
<th>Effectiveness:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUM_ENCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 30210 ENC_SEGMENT_NR [n]: 0...max. encoder–1

Actual value assignment: Drive type

<table>
<thead>
<tr>
<th>Actual value assignment: Drive type</th>
<th>Relevant:</th>
<th>Protection level:</th>
<th>Unit:</th>
<th>Standard:</th>
<th>Minimum:</th>
<th>Maximum:</th>
<th>Data type:</th>
<th>Effectiveness:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC_SEGMENT_NR [n]: 0...max. encoder–1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 30220 ENC_MODULE_NR [n]: 0...max. encoder–1

Actual value assignment: Drive number/measuring circuit number

<table>
<thead>
<tr>
<th>Actual value assignment: Drive number/measuring circuit number</th>
<th>Relevant:</th>
<th>Protection level:</th>
<th>Unit:</th>
<th>Standard:</th>
<th>Minimum:</th>
<th>Maximum:</th>
<th>Data type:</th>
<th>Effectiveness:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC_MODULE_NR [n]: 0...max. encoder–1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 30230 ENC_INPUT_NR [n]: 0...max. encoder–1

Actual value assignment: Input on drive module/measuring circuit card

<table>
<thead>
<tr>
<th>Actual value assignment: Input on drive module/measuring circuit card</th>
<th>Relevant:</th>
<th>Protection level:</th>
<th>Unit:</th>
<th>Standard:</th>
<th>Minimum:</th>
<th>Maximum:</th>
<th>Data type:</th>
<th>Effectiveness:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC_INPUT_NR [n]: 0...max. encoder–1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 30240 ENC_TYPE [n]: 0...max. encoder–1

Type of actual value acquisition

- 0: Simulation
- 1: Signal generator, high-resolution
- 2: Square-wave encoder, standard encoder (pulse multiplication)
- 3: Encoder for stepper motor
- 4: Absolute encoder with EnDat interface

<table>
<thead>
<tr>
<th>Type of actual value acquisition</th>
<th>Relevant:</th>
<th>Protection level:</th>
<th>Unit:</th>
<th>Standard:</th>
<th>Minimum:</th>
<th>Maximum:</th>
<th>Data type:</th>
<th>Effectiveness:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENC_TYPE [n]: 0...max. encoder–1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.4 Actual value

Example

<table>
<thead>
<tr>
<th>MD 30200: NUM_ENCS = 1</th>
<th>Analog axis has a measuring system</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD 30210: ENC_SEGMENT_NR = 1</td>
<td>Bus segment 840D</td>
</tr>
<tr>
<td>MD 30220: ENC_MODULE_NR =</td>
<td>Module number of active digital drive</td>
</tr>
<tr>
<td>MD 30230: ENC_INPUT_NR[0] = 1</td>
<td>Measuring system 1</td>
</tr>
<tr>
<td>MD 30240: ENC_TYPE[0] = 1</td>
<td>Encoder type: Signal generator</td>
</tr>
</tbody>
</table>

The first measuring system is activated with the PLC signal to axis DB31–48, DBX1.5.

3.5 Necessary parameter presettings

“Dynamic stiffness control” (DSC) must not be activated (MD 32640: STIFFNESS_CONTROL_ENABLE=0).

3.6 System variables

The NC control can read in measuring signals that are present at connectors X121/X122 or X111/X112 via system variables.

Table 3-2 Assignment of system variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Connector</th>
<th>Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>$VA_VALVELIFT[X]</td>
<td>X121/X122</td>
<td>14 and 15</td>
</tr>
<tr>
<td>$VA_PRESSURE_A[X]</td>
<td>X111/X112</td>
<td>11 and 12</td>
</tr>
<tr>
<td>$VA_PRESSURE_B[X]</td>
<td>X111/X112</td>
<td>14 and 15</td>
</tr>
</tbody>
</table>
3.7 Start-up functions

3.7.1 General

- Measuring functions
  - Measuring speed control loop
  - Measuring position control loop
- Function generator
- Circularity test
- Servo trace
- DAC configuration

![Start-up functions menu display](image)

Fig. 3-3  “Start-up functions” menu display

**Disabled softkeys**

The softkey “Current control loop” in the “Start-up functions” menu is disabled for axes with ANA, as this is a special function for FDD/MSD.

Also, the softkey “Aut. control setting” in the “Start-up functions” menu is disabled for axes with ANA, as the implemented algorithms are designed for automatic control setting for electrical digital drives.
### 3.7.2 Measuring function

The measuring functions allow on-screen evaluation of the most important dimensions of speed and position control loop in the time and frequency domain without external measuring devices.

The measuring functions are executed in the position control cycle.

The following measuring functions can be performed with ANA:

- Speed control loop measurements
  - Reference frequency response
  - Set-point step change

- Position control loop measurements
  - Reference frequency response
  - Set-point step change
  - Set-point ramp

#### Speed control loop measurement

Table 3-3 Measuring types and measured variables in speed control loop measurements

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Starting</th>
<th>Measured variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference frequency response</td>
<td>Speed set-point, speed control loop closed</td>
<td>Speed actual value/speed set-point</td>
</tr>
<tr>
<td>Set-point step change</td>
<td>Speed set-point, speed control loop closed</td>
<td>Measured variable 1: Speed set-point &lt;br&gt; Measured variable 2: Speed actual value</td>
</tr>
</tbody>
</table>

#### Position control loop measurement

Table 3-4 Measuring types and measured variables in position control loop measurements

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Starting</th>
<th>Measured variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference frequency response</td>
<td>Position set-point, position control loop closed</td>
<td>Position actual value/position set-point</td>
</tr>
<tr>
<td>Set-point step change</td>
<td>Position set-point, position control loop closed</td>
<td>Measured variable 1: Position set-point &lt;br&gt; Measured variable 2: Position actual value &lt;br&gt; Control deviation &lt;br&gt; Following error &lt;br&gt; Speed actual value</td>
</tr>
<tr>
<td>Set-point ramp</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.7.3 Function generator

The function generator activates the drive with a periodic signal; the signal type can be parameterized. External measuring devices can be connected via DAC output sockets, for example, oscillographs to evaluate system responses. The following signals (operating modes) and signal types are possible with ANA:

- Signals (operating modes)
  - Speed set-point
  - Position actual value
- Signal type
  - Square-wave
  - Noise signal (only meaningful with DAC output of signals and external analyzing units for frequency response analyses)

For information on using the function generator, please refer to References: /FBA/, DD2 “Speed control loop”

![Function generator selection signal menu display](Fig. 3-4)

3.7.4 Circularity test

The circularity test is among other things a control function for the contour precision achieved. The actual positions are measured in a circular movement. The deviation from the programmed radius (especially on the quadrant transitions) is displayed graphically. For more detailed information, see:

References: /FB/ Part 2, K3, Section 2.7 “Circularity test”
3.8 Servo trace

The servo trace function serves for the graphic display of signals and operating states.

A signal list (servo signals) is provided to support axes with ANA module.

The following signals are supported by the servo trace:

- Following error
- Control deviation
- Contour deviation
- Position actual value measuring system 1
- Position actual value
- Speed actual value active encoder
- Speed set-point for drive
- Controller mode
- Active measuring system
- Position set-point controller input
- Speed set-point controller input
- Acceleration set-point controller input
- Speed actual value measuring system 1
- Signal interpolation terminated
- Signals exact stop fine
- Signals exact stop coarse
3.9 DAC parameterization (available soon)

DAC measuring sockets see Chapter 4.1.5.

Functionality

Three 8-bit digital/analog converter (DAC) channels are available on the ANA module. An analog image of various servo signals can be switched to a measuring socket via these channels.

With the 8 bits (=1 byte) of the DAC it is only possible to display a section of the selected signal, see Fig. 3-6. Therefore, it is necessary to set the required fineness for quantization of the selected signal via the shift factor. The normalization factor is determined when the parameters are set and displayed for the user.
3.9 DAC parameterization (available soon)

**Activation of analog output**

The screen for activation and parameterization of the DAC outputs is accessed from the basic machine display via softkeys Start-Up / Drive/servo / Configur. DAC.

The configuration is activated by pressing Start. Active DACs are highlighted in the left-hand side of the screen (active/inactive). Display is terminated by pressing Stop (active/inactive).

The selected signals are also active after POWER ON.

**Output voltage range**

The DAC operates with a voltage of 0 V to +5 V. The output voltage of 2.5 V corresponds to the zero value of the represented signal. The two's complement is used for the digital/analog conversion, see Fig. 3-6.

![Analog output voltage range diagram](image)

Fig. 3-7 Analog output voltage range
Hardware

4.1 Overview of interfaces

Fig. 4-1 ANA closed-loop control plug-in unit (2-axis)
4 Hardware

4.1 Overview of interfaces

Fig. 4-2  Layout of ANA closed-loop control plug-in unit
4.1.1 Measuring system

One measuring system can be evaluated on the module per axis.

- X101: Axis 1
- X102: Axis 2

The measuring system must always be plugged into the connector for the associated axis.

For more information, please refer to Chapter 6.1.

Table 4-1 Connector X101, X102; both 15-pin D-sub two-tier connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>X101</th>
<th>X102</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PENC0</td>
<td>PENC2</td>
<td>Encoder power supply</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>M</td>
<td>Ground for encoder power supply</td>
</tr>
<tr>
<td>3</td>
<td>AP0</td>
<td>AP2</td>
<td>Incremental signal A</td>
</tr>
<tr>
<td>4</td>
<td>AN0</td>
<td>AN2</td>
<td>Inverse incremental signal A</td>
</tr>
<tr>
<td>5</td>
<td>BMIDAT0</td>
<td>BMIDAT2</td>
<td>Data signal EnDat interface</td>
</tr>
<tr>
<td>6</td>
<td>BP0</td>
<td>BP2</td>
<td>Incremental signal B</td>
</tr>
<tr>
<td>7</td>
<td>BN0</td>
<td>BN2</td>
<td>Inverse incremental signal B</td>
</tr>
<tr>
<td>8</td>
<td>XBMDAT0</td>
<td>XBMDAT2</td>
<td>Inverse data signal EnDat interface</td>
</tr>
<tr>
<td>9</td>
<td>PSENSE0</td>
<td>PSENSE2</td>
<td>Remote sense encoder power supply (P)</td>
</tr>
<tr>
<td>10</td>
<td>RP0</td>
<td>RP2</td>
<td>Incremental signal R</td>
</tr>
<tr>
<td>11</td>
<td>MSENSE0</td>
<td>MSENSE2</td>
<td>Remote sense encoder power supply (M)</td>
</tr>
<tr>
<td>12</td>
<td>RN0</td>
<td>RN2</td>
<td>Inverse incremental signal R</td>
</tr>
<tr>
<td>13</td>
<td>M</td>
<td>M</td>
<td>Ground (for inner shields)</td>
</tr>
<tr>
<td>14</td>
<td>BMICLK0</td>
<td>BMICLK2</td>
<td>Clock signal EnDat interface</td>
</tr>
<tr>
<td>15</td>
<td>XBMICLK0</td>
<td>XBMICLK2</td>
<td>Inverse clock signal EnDat interface</td>
</tr>
</tbody>
</table>
4.1 Overview of interfaces

4.1.2 Analog sensors

Connection for 2 sensors per axis

- X111: Axis 1 (sensor 1A, 1B)
- X112: Axis 2 (sensor 2A, 2B)

<table>
<thead>
<tr>
<th>Pin</th>
<th>X111/Type</th>
<th>X112/Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P24EXT</td>
<td>Q</td>
<td>P24EXT, from X431.5</td>
</tr>
<tr>
<td>2</td>
<td>P24EXT</td>
<td>Q</td>
<td>P24EXT, from X431.5</td>
</tr>
<tr>
<td>3</td>
<td>–</td>
<td>–</td>
<td>Not assigned</td>
</tr>
<tr>
<td>4</td>
<td>–</td>
<td>–</td>
<td>Not assigned</td>
</tr>
<tr>
<td>5</td>
<td>M24EXT</td>
<td>Q</td>
<td>M24EXT, from X431.6</td>
</tr>
<tr>
<td>6</td>
<td>–</td>
<td>–</td>
<td>Not assigned</td>
</tr>
<tr>
<td>7</td>
<td>–</td>
<td>–</td>
<td>Not assigned</td>
</tr>
<tr>
<td>8</td>
<td>–</td>
<td>–</td>
<td>Not assigned</td>
</tr>
<tr>
<td>9</td>
<td>M24EXT</td>
<td>Q</td>
<td>M24EXT, from X431.6</td>
</tr>
<tr>
<td>10</td>
<td>M24EXT</td>
<td>Q</td>
<td>M24EXT, from X431.6</td>
</tr>
<tr>
<td>11</td>
<td>IST1BN</td>
<td>I</td>
<td>Analog actual value signal, reference ground</td>
</tr>
<tr>
<td>12</td>
<td>IST1BP</td>
<td>I</td>
<td>Analog actual value signal, max. range 0...10 V</td>
</tr>
<tr>
<td>13</td>
<td>M24EXT</td>
<td>Q</td>
<td>M24EXT, from X431.6</td>
</tr>
<tr>
<td>14</td>
<td>IST1AN</td>
<td>I</td>
<td>Analog actual value signal, reference ground</td>
</tr>
<tr>
<td>15</td>
<td>IST1AP</td>
<td>I</td>
<td>Analog actual value signal, max. range 0...10 V</td>
</tr>
</tbody>
</table>

1) I: Input, Q: Output

The inputs are differential with 40 kΩ input resistance.
The input voltage range is 0...+10 V.

The supply output P24EXT has an electronic short–circuit protection. The supply output is designed for a total current (4 sensors) of 200 mA.
4.1.3 Analog set-point and actual values

- X121: Axis 1
- X122: Axis 2

Table 4-3 Connector X121, X122; both 15-pin Sub-D connector socket

<table>
<thead>
<tr>
<th>Pin</th>
<th>X121</th>
<th>X122</th>
<th>Type(^1)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P24RV1</td>
<td>P24RV2</td>
<td>Q</td>
<td>P24EXT switched, from X431.5</td>
</tr>
<tr>
<td>2</td>
<td>P24RV1</td>
<td>P24RV2</td>
<td>Q</td>
<td>P24EXT switched, from X431.5</td>
</tr>
<tr>
<td>3</td>
<td>P24RV1</td>
<td>P24RV2</td>
<td>Q</td>
<td>P24EXT switched, from X431.5</td>
</tr>
<tr>
<td>4</td>
<td>P24RV1</td>
<td>P24RV2</td>
<td>Q</td>
<td>P24EXT switched, from X431.5</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>M</td>
<td></td>
<td>Electronic ground</td>
</tr>
<tr>
<td>6</td>
<td>USOLL1N</td>
<td>USOLL2N</td>
<td>Q</td>
<td>Analog set-point output, reference ground</td>
</tr>
<tr>
<td>7</td>
<td>USOLL1P</td>
<td>USOLL2P</td>
<td>Q</td>
<td>Analog set-point output +/- 10 V</td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>M</td>
<td></td>
<td>Electronic ground</td>
</tr>
<tr>
<td>9</td>
<td>M24EXT</td>
<td>M24EXT</td>
<td>Q</td>
<td>M24EXT, from X431.6</td>
</tr>
<tr>
<td>10</td>
<td>M24EXT</td>
<td>M24EXT</td>
<td>Q</td>
<td>M24EXT, from X431.6</td>
</tr>
<tr>
<td>11</td>
<td>M24EXT</td>
<td>M24EXT</td>
<td>Q</td>
<td>M24EXT, from X431.6</td>
</tr>
<tr>
<td>12</td>
<td>–</td>
<td>–</td>
<td></td>
<td>Not assigned</td>
</tr>
<tr>
<td>13</td>
<td>M</td>
<td>M</td>
<td></td>
<td>Electronic ground</td>
</tr>
<tr>
<td>14</td>
<td>UIST1N</td>
<td>UIST2N</td>
<td>I</td>
<td>Analog actual value input, ref. ground</td>
</tr>
<tr>
<td>15</td>
<td>UIST1P</td>
<td>UIST2P</td>
<td>I</td>
<td>Analog actual value input +/- 10 V</td>
</tr>
</tbody>
</table>

\(^1\) I: Input, Q: Output

The analog actual value inputs are differential with 100 kΩ input resistance. Load capability for the 24 V outputs:

- at an ambient temperature of 40 °C 2.0 A
- at an ambient temperature of 55 °C 1.5 A

for the mean current value with a load cycle of 10 s duration.

There can be linear interpolation between the temperature vertexes.

The short-term load capacity of the switched P24EXT outputs is 3.0 A (200 ms).

Fuse F1900 or F1901 is destroyed on the ANA module (location see Fig. 4-2) in the event of overloading.

Fuse

Outputs 24 V switched for axis 1 and 2 are protected by means of a miniature fuse F1900 (axis 1) or F1901 (axis 2).

Value: 2.5 AF/250 V; 5x20 mm UL

Manufacturer: Wickmann-Werke GmbH
Annenstraße 113
D-58453 Witten
or
Postfach 2520
D-58415 Witten
Germany

Order no.: 19194
4.1.4 Terminals

24 V external power supply, enable, BER0 inputs

- X431: Axis 1
- X432: Axis 2

Table 4-4 Connector X431; 8-pin Phoenix Combicon connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>X431</th>
<th>Type1)</th>
<th>Function</th>
<th>Typ. voltage/ limit values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>I</td>
<td>Electronic ground</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PV1</td>
<td>Q</td>
<td>P24EXT switched, axis 1</td>
<td>Max. 2.0 A</td>
</tr>
<tr>
<td>3</td>
<td>MV1</td>
<td>Q</td>
<td>M24EXT switched, axis 1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>C1</td>
<td>–</td>
<td>Reserved, do not connect</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>P24</td>
<td>I</td>
<td>Input +24 V external</td>
<td>26.5 V ± 2 %</td>
</tr>
<tr>
<td>6</td>
<td>M24</td>
<td>I</td>
<td>Input 0 V external</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>663</td>
<td>I</td>
<td>Module-specific enable</td>
<td>21 V...30 V</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>Q</td>
<td>Enabling voltage, internal, +24 V</td>
<td></td>
</tr>
</tbody>
</table>

Table 4-5 Connector X432; 8-pin Phoenix Combicon connector

<table>
<thead>
<tr>
<th>Pin</th>
<th>X432</th>
<th>Type1)</th>
<th>Function</th>
<th>Typ. voltage/ limit values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>I</td>
<td>Electronic ground</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PV2</td>
<td>Q</td>
<td>P24EXT switched, axis 2</td>
<td>Max. 2.0 A</td>
</tr>
<tr>
<td>3</td>
<td>MV2</td>
<td>Q</td>
<td>M24EXT switched, axis 2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>C2</td>
<td>–</td>
<td>Reserved, do not connect</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>B1</td>
<td>I</td>
<td>BER0 input axis 1</td>
<td>13 V...30 V</td>
</tr>
<tr>
<td>6</td>
<td>19</td>
<td>Q</td>
<td>Enabling voltage, internal, ground T:19</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>B2</td>
<td>I</td>
<td>BER0 input axis, 2</td>
<td>13 V...30 V</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>Q</td>
<td>Enabling voltage, internal, +24 V</td>
<td></td>
</tr>
</tbody>
</table>

Note

It is **not permissible** to have a connection (jumper) between X431.6 and X432.3!

Max. terminal cross section 2.5 mm².

Outputs X431.2 and X432.2 (P24EXT switched, axis 1 and 2) are short-circuit proof. The user must limit the energy absorption when cutting off inductive loads to 1.7 J (see also Chapter 2.4.2). Should reversed polarity occur, then the outputs are not protected against overload. The power supply must be external (via X431.5 and X431.6).

P24EXT=26.5 V ±2% according to external supply (Chapter 2.4.2).

---

1) I = Input; Q = Output
Enable inputs  Module-specific enable takes place via terminal 663. The input is evaluated by means of the optocoupler in the ANA module. The enabling voltage can be picked up from terminal 9.
Terminal 663 is specific to the internal enabling voltage (ground, terminal 19).

4.1.5 Measuring sockets (diagnostics)

Measuring sockets  Internal signals can be assigned to the ANA module’s measuring sockets by means of the Start-up tool or MMC102/103 (in conjunction with SINUMERIK 840D); they are available there as analog values (see also Chapter 3.9).

![Measuring sockets diagram]

DAC1  DAC2  X35
DAC3  Ground  X34

4.1.6 Bus interfaces

Drive bus  (see SIMODRIVE 611A/D)
- X141: Input
- X341: Output
A bus terminator must be connected on the last module.

Device bus  (see SIMODRIVE 611A/D)
- X151: Device bus
4.2 Note

4.2.1 Climatic and mechanical environmental conditions during operation

Applicable standards

IEC 68-2-1, IEC 68-2-2, IEC 68-2-3

Climatic environmental conditions

If the operating temperature cannot be kept within the values specified, it is advisable to connect a heat exchanger or air conditioner.

Table 4-6 Climatic environmental conditions

<table>
<thead>
<tr>
<th>Temperature range</th>
<th>Lower temperature limit</th>
<th>Upper temperature limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0°C</td>
<td>+55°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dew point temperature td and Relative air humidity U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean annual value</td>
</tr>
<tr>
<td>U = 75%, td = 17°C</td>
</tr>
<tr>
<td>On 30 days (24 hours) per year (days distributed through the year)</td>
</tr>
<tr>
<td>U = 95%, td = 24°C</td>
</tr>
<tr>
<td>On the other days (&lt;24 hours) (keeping to the mean annual values)</td>
</tr>
<tr>
<td>U = 85%, td = 20°C</td>
</tr>
</tbody>
</table>

Moisture condensation

Not permissible

Temperature change

Within an hour 10 K
Within three minutes 1 K

Atmospheric pressure

With operation up to 1500 m above NN. At greater altitudes the upper limit temperature must be reduced by 3.5°C/500m.

86 kPa to 108 kPa

Table 4-7 Mechanical environmental conditions

Vibration stress (acc. to IEC 68–2–6)

Frequency range

10–58 Hz
over 58–500 Hz

Constant deflection 0.075 mm
Ampl. of acceleration 9.8 m/s²

Shock during operation (Testing cat. E, testing Ea acc. to IEC 68, Section 2–27)

Acceleration 5 g

Duration of nominal shock
11 ms for device without drive
30 ms for device with drive
4.2.2 Transport and storage conditions

Note
The following specifications are applicable to the electrical part of the ANA module.

Applicable standards
IEC 68-2-1, IEC 68-2-2, IEC 68-2-3

Modules in original packaging
The following specifications are applicable for modules in original packaging:

Table 4-8 Climatic conditions

<table>
<thead>
<tr>
<th>Temperature range</th>
<th>Lower temperature limit</th>
<th>–40°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper temperature limit</td>
<td>+70°C</td>
<td></td>
</tr>
<tr>
<td>Dew point temperature td and relative air humidity U</td>
<td>Mean annual value</td>
<td>U = 75%, td = 17°C</td>
</tr>
<tr>
<td></td>
<td>On 30 days (24 hours) per year (days distributed through the year)</td>
<td>U = 95%, td = 24°C</td>
</tr>
<tr>
<td></td>
<td>On 30 days (24 hours) per year (days distributed through the year)</td>
<td>U = 85%, td = 20°C</td>
</tr>
<tr>
<td>Moisture condensation</td>
<td>The following cases can apply at the same time for moisture condensation:</td>
<td>Seldom, briefly, slightly</td>
</tr>
<tr>
<td></td>
<td>Max. duration of moisture condensation</td>
<td>3 hours</td>
</tr>
<tr>
<td></td>
<td>Moisture condensation frequency</td>
<td>Mean annual value: 3 / max.: 10</td>
</tr>
<tr>
<td></td>
<td>Shortest sequence of moisture condensation cycles</td>
<td>1 day</td>
</tr>
<tr>
<td>Temperature change</td>
<td>Within one hour</td>
<td>20 K</td>
</tr>
<tr>
<td>Atmospheric pressure</td>
<td>The specified values correspond to a transport altitude of up to 3265 m above NN</td>
<td>66 kPa to 108 kPa</td>
</tr>
</tbody>
</table>

Table 4-9 Mechanical conditions during transport in original packaging

<table>
<thead>
<tr>
<th>Oscillation stress (acc. to IEC 68-2-6)</th>
<th>Frequency range 5–9 Hz</th>
<th>Const. deflection 3.5 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>over 9–500 Hz</td>
<td>Ampl. of acceleration 10 m/s²</td>
</tr>
</tbody>
</table>
4.2.3 Stress through pollutants

Applicable standards

DIN 40046, Part 36 and Part 37

Table 4-10 Gases posing a risk to operation

<table>
<thead>
<tr>
<th>Gases posing a risk to operation</th>
<th>Severity</th>
<th>Temperature</th>
<th>Relative air humidity</th>
<th>Testing duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur dioxide (SO₂)</td>
<td>10 cm³/m³ ± 0.3 cm³/m³</td>
<td>25 °C ± 2 °C</td>
<td>75% ± 5%</td>
<td>4 days</td>
</tr>
<tr>
<td>Testing conditions:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen sulphide (H₂S)</td>
<td>1 cm³/m³ ± 0.3 cm³/m³</td>
<td>25 °C ± 2 °C</td>
<td>75% ± 5%</td>
<td>4 days</td>
</tr>
<tr>
<td>Testing conditions:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dust posing a risk to operation

If the controller is to be operated in a location where dust contamination could pose a risk, it is advisable to install the controller in a cabinet fitted with a heat exchanger or suitable air inlet.
Diagnostics

Alarms

There are no special drive alarms.
NC alarms are described in:

References:  /DA/, Diagnostics Guide

For special cases of operation together with an integrated PLC, please refer to the reference manuals for the SIMATIC S7-300 system.
6

I/Os/Accessories

6.1 Measuring systems

6.1.1 Encoders, linear measuring systems

Note
Pin assignment see Chapter 4.1.1.

Encoder specification

The ANA module is designed for evaluation of

- Incremental measuring system with sinusoidal signals (A, B) and a reference signal (R)
  or

- Absolute measuring system with sinusoidal signals (A, B) and EnDat interface for absolute position sensing

with the following signal limit data:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Signal voltages</th>
<th>Mech. angle $\phi$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track signal A</td>
<td>$V_{M(A)}$</td>
<td>Track signal *A</td>
</tr>
<tr>
<td>Differential signal (A – *A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track signal B</td>
<td>$V_{M(B)}$</td>
<td>Track signal *B</td>
</tr>
<tr>
<td>Differential signal (B – *B)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track signal R</td>
<td>$V_{M(R)}$</td>
<td>Track signal *R</td>
</tr>
<tr>
<td>Differential signal (R – *R)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 6-1 Required signal chart of measuring system for data definition
6 I/Os/Accessories

6.1 Measuring systems

Table 6-1 Measuring system signal key data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Designation</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean voltage</td>
<td>( V_{M(A)}; V_{M(B)}; V_{M(R)} )</td>
<td>1.75</td>
<td>3.25</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Amplitude</td>
<td>( A - * A; B - * B )</td>
<td>350</td>
<td>500</td>
<td>600</td>
<td>mv</td>
</tr>
<tr>
<td>Ratio</td>
<td>( (A - * A)/(B - * B) )</td>
<td>0.9</td>
<td>1.0</td>
<td>1.1</td>
<td>–</td>
</tr>
<tr>
<td>Dynamic amplitude change</td>
<td>( \Delta(A - * A)/360^\circ )</td>
<td>–</td>
<td>–</td>
<td>0.3</td>
<td>mV/360^\circ</td>
</tr>
<tr>
<td>Direct component</td>
<td>( V_{G(A)}/\text{amplitude} (A - * A); V_{G(B)}/\text{amplitude} (B - * B) )</td>
<td>-0.2</td>
<td>0</td>
<td>+0.2</td>
<td></td>
</tr>
<tr>
<td>Dynamic change of direct component</td>
<td>( \Delta V_{G(A)}/360^\circ ); ( \Delta V_{G(B)}/360^\circ )</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>mV/360^\circ</td>
</tr>
<tr>
<td>Signal frequency</td>
<td>( f_s )</td>
<td>–</td>
<td>–</td>
<td>200</td>
<td>kHz</td>
</tr>
<tr>
<td>Phase shift</td>
<td>( \beta )</td>
<td>85</td>
<td>90</td>
<td>95</td>
<td>Degrees</td>
</tr>
<tr>
<td>Harmonic distortion(^1)</td>
<td>( k )</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>%</td>
</tr>
<tr>
<td>Useful signal</td>
<td>( R - * R )</td>
<td>300</td>
<td>–</td>
<td>1500</td>
<td>mV</td>
</tr>
<tr>
<td>Direct voltage</td>
<td>( V_{G(R)} )</td>
<td>–150</td>
<td>–</td>
<td>–500</td>
<td>mV</td>
</tr>
<tr>
<td>Unambiguous range</td>
<td>( \alpha_1; \alpha_2 )</td>
<td>50</td>
<td>–</td>
<td>270</td>
<td>Degrees</td>
</tr>
</tbody>
</table>

\(^1\) Definition for harmonic distortion: 
\[
k = \sqrt{\frac{U_{11}^2 + U_{12}^2 + \ldots + U_{n}^2}{U_0^2 + U_{11}^2 + \ldots + U_{n}^2}}
\]

\(U_0: \) Fundamental component
\(U_{1...n}: \) Harmonic component
Note
You need to take speed ripple/positioning inaccuracy or other error functions into account for signals that are outside the signal specification.

6.1.2 Interconnection diagrams

Connection possibilities

![Connection diagram]

Fig. 6-3 Example connection possibilities for measuring system cable

1) The cable can be ordered from the manufacturer of the linear scale.
6.1 Measuring systems

Fig. 6-4 Measuring system for encoder with voltage signals (X101/X102)

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15-pin Sub D female connector, with screw interlock</td>
</tr>
<tr>
<td></td>
<td>6FC9348-7HX</td>
</tr>
<tr>
<td>2</td>
<td>Signal cable 4x2x0.38+4x0.5</td>
</tr>
<tr>
<td></td>
<td>6FX2008-1BD21</td>
</tr>
<tr>
<td>3</td>
<td>Connector 12-pin</td>
</tr>
<tr>
<td></td>
<td>6FX2003-0CE12</td>
</tr>
</tbody>
</table>

Order no. for measuring system cable: 6FX2002-2CA11-1□□□□
6.1 Measuring systems

Fig. 6-5 Measuring system for encoder with voltage signals +EnDat (X101/X102)

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15-pin Sub D female connector, with screw interlock 6FC9348-7HX</td>
</tr>
<tr>
<td>2</td>
<td>Signal cable 3x2x0,14+4x0,14+2x0,5 6FX2008-1BD41</td>
</tr>
<tr>
<td>3</td>
<td>Connector 17-pin 6FX2003-0CE17</td>
</tr>
</tbody>
</table>

Order no. for cable: 6FX2002-2AD00-1□□□
6.2 BERO (X432)

You can only connect type 3 conductor PNP make contact BEROs. We recommend e.g.:

SIEMENS  BERO M30 3RG 4014-0AG01
          BERO M12 3RG 4012-3AG01

Note
The BERO cable must be shielded.

Table 6-2 Pin assignment X432

<table>
<thead>
<tr>
<th>Terminal marking</th>
<th>Type 1)</th>
<th>Signal designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1/B2</td>
<td>I</td>
<td>BERO (external reference signal) axis 1/2</td>
</tr>
<tr>
<td>19</td>
<td>Q</td>
<td>Power supply for BERO external ground</td>
</tr>
<tr>
<td>9</td>
<td>Q</td>
<td>Power supply for BERO 24 V external</td>
</tr>
</tbody>
</table>

1) I: Input, Q: Output
## Service

### 7.1 Hotline

<table>
<thead>
<tr>
<th>Siemens AG</th>
<th>Hotline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tel. No.</td>
<td>+49 180 525 8008 (numerical)</td>
</tr>
<tr>
<td>Fax</td>
<td>+49 180 525 8009</td>
</tr>
<tr>
<td>Tel. No.</td>
<td>+49 9131/98-3471 (FDD) and -3475 (MSD)</td>
</tr>
<tr>
<td>Fax</td>
<td>+49 9131/98-1313</td>
</tr>
<tr>
<td>Mo–Fr</td>
<td>8:00 am – 5:00 pm</td>
</tr>
</tbody>
</table>

**Standby service**

| Tel. No.   | +49 172 840 8776                |
| Mo–Fr      | 5:00 pm – 10:00 pm              |
| Saturday   | 8:00 pm – 10:00 pm              |
| 12/24      | 8:00 am – 2:00 pm               |
| 12/31.     | 8:00 am – 2:00 pm               |
| Sunday     | None                             |
## Abbreviations

<table>
<thead>
<tr>
<th>ANA</th>
<th>Analog drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARM (MSD)</td>
<td>Asynchronous rotation motor (main spindle drive)</td>
</tr>
<tr>
<td>AS</td>
<td>Automation System</td>
</tr>
<tr>
<td>AT</td>
<td>Advanced Technology</td>
</tr>
<tr>
<td>BERO</td>
<td>Proximity limit switch</td>
</tr>
<tr>
<td>COM</td>
<td>Communication Module</td>
</tr>
<tr>
<td>DAC</td>
<td>Digital/analog converter channel</td>
</tr>
<tr>
<td>D/A</td>
<td>Digital to Analog</td>
</tr>
<tr>
<td>DP</td>
<td>Distributed Peripherals (I/Os)</td>
</tr>
<tr>
<td>DRV</td>
<td>Driver Module</td>
</tr>
<tr>
<td>DSC</td>
<td>Dynamic Stiffness Control</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
</tr>
<tr>
<td>ESD</td>
<td>Modules/components endangered by electrostatic discharge</td>
</tr>
<tr>
<td>EUS</td>
<td>End User Interfaces</td>
</tr>
<tr>
<td>FDD</td>
<td>Feed Drive</td>
</tr>
<tr>
<td>FFT</td>
<td>Fast Fourier Transform</td>
</tr>
<tr>
<td>FRM</td>
<td>Enabling voltage internal ground</td>
</tr>
<tr>
<td>FRP</td>
<td>Enabling voltage internal +24 V</td>
</tr>
<tr>
<td>HD</td>
<td>Hard Disk</td>
</tr>
<tr>
<td>HHU</td>
<td>Handheld Unit</td>
</tr>
<tr>
<td>HLD</td>
<td>Hydraulic Linear Drive</td>
</tr>
<tr>
<td>I/RF</td>
<td>Infeed/Regenerative Feedback Module</td>
</tr>
<tr>
<td>IM</td>
<td>Interface Module (SIMATIC S7-300)</td>
</tr>
<tr>
<td>IM Address</td>
<td>Interface Module Address</td>
</tr>
<tr>
<td>ISA</td>
<td>Industry Standard Architecture</td>
</tr>
<tr>
<td>K Bus</td>
<td>Communication Bus</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>M24EX</td>
<td>External 0 V input</td>
</tr>
<tr>
<td>MCP</td>
<td>Machine Control Panel</td>
</tr>
<tr>
<td>MD</td>
<td>Machine Data</td>
</tr>
<tr>
<td>MLFB</td>
<td>Machine-readable product designation (Order No.)</td>
</tr>
</tbody>
</table>
A Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMC</td>
<td>Man Machine Communication</td>
</tr>
<tr>
<td>MPI</td>
<td>MultiPoint Interface</td>
</tr>
<tr>
<td>MSD</td>
<td>Main Spindle Drive</td>
</tr>
<tr>
<td>NC</td>
<td>Numerical Control</td>
</tr>
<tr>
<td>NCU</td>
<td>Numeric Control Unit</td>
</tr>
<tr>
<td>NE</td>
<td>Mains Infeed (module)</td>
</tr>
<tr>
<td>NMI</td>
<td>Non-Maskable Interrupt</td>
</tr>
<tr>
<td>OP</td>
<td>Operator Panel</td>
</tr>
<tr>
<td>OPI</td>
<td>Operator Panel Interface</td>
</tr>
<tr>
<td>P24EXT</td>
<td>External +24 V input</td>
</tr>
<tr>
<td>PBL</td>
<td>Parameter Basic List</td>
</tr>
<tr>
<td>P Bus</td>
<td>I/O Bus</td>
</tr>
<tr>
<td>PCMCIA</td>
<td>Personal Computer Memory Card International Association</td>
</tr>
<tr>
<td>PER</td>
<td>I/O Module</td>
</tr>
<tr>
<td>PG</td>
<td>Programming Unit</td>
</tr>
<tr>
<td>PI</td>
<td>Program Invocation</td>
</tr>
<tr>
<td>PID</td>
<td>Controller with Proportional, Integral and Differential components</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable Logic Controller</td>
</tr>
<tr>
<td>PS</td>
<td>Power Supply (SIMATIC S7-300)</td>
</tr>
<tr>
<td>RK</td>
<td>Control loop</td>
</tr>
<tr>
<td>SCI</td>
<td>Serial Communication Control</td>
</tr>
<tr>
<td>SLM</td>
<td>Synchronous Linear Motor</td>
</tr>
<tr>
<td>SM</td>
<td>Signal Module of SIMATIC S7-300, e.g. I/O modules</td>
</tr>
<tr>
<td>SRM (FDD)</td>
<td>Synchronous Rotation Motor (feed drive)</td>
</tr>
<tr>
<td>SW</td>
<td>Software</td>
</tr>
<tr>
<td>Term.</td>
<td>Terminal</td>
</tr>
<tr>
<td>UE</td>
<td>Unregulated incoming supply</td>
</tr>
<tr>
<td>ÜW</td>
<td>Monitoring</td>
</tr>
<tr>
<td>VGA</td>
<td>Video Graphics Adapter</td>
</tr>
<tr>
<td>ZK</td>
<td>Status class</td>
</tr>
</tbody>
</table>
References

General Documentation

/BU/  SINUMERIK 840D/810D/FM-NC
Ordering Information
Catalog NC 60.1
Order No.: E86060-K4460-A101-A6-7600

/ST7/  SIMATIC
SIMATIC S7 Programmable Logic Controllers
Catalog ST 70
Order No.: E86 060-K4670-A111-A3

/VS/  SINUMERIK 840D/810D/FM-NC
Technical Information
Catalog NC 60.2
Order No.: E86060-D4460-A201-A4-7600

/W/  SINUMERIK 840D/810D/FM-NC
Brochure

/Z/  SINUMERIK, SIROTEC, SIMODRIVE
Accessories and Equipment for Special-Purpose Machines
Catalog NC Z
Order No.: E86060-K4490-A001-A6-7600

Electronic Documentation

/CD6/  The SINUMERIK System
(04.00 Edition)
DOC ON CD
(includes all SINUMERIK 840D/810D/FM-NC and SIMODRIVE 611D publications)
Order No.: 6FC5 298-5CA00-0BG2
User Documentation

/AUE/
SINUMERIK 840D/810D/FM-NC
AutoTurn Graphic Programming System
Operator's Guide
Part 2: Setup
Order No.: 6FC5 298-4AA50-0BP2
(07.99 Edition)

/AUK/
SINUMERIK 840D/810D/FM-NC
Short Guide AutoTurn Operation
Order No.: 6FC5 298-4AA30-0BP2
(07.99 Edition)

/AUP/
SINUMERIK 840D/810D/FM-NC
AutoTurn Graphic Programming System
Operator's Guide
Part 1: Programming
Order No.: 6FC5 298-4AA40-0BP2
(07.99 Edition)

/BA/
SINUMERIK 840D/810D/FM-NC
Operator's Guide
Order No.: 6FC5 298-5AA00-0BP2
- Operator's Guide
- Operator's Guide Interactive Programming (MMC 102/103)
(04.00 Edition)

/BAE/
SINUMERIK 840D/810D/ FM-NC
Operator's Guide Unit Operator Panel
Order No.: 6FC5 298-3AA60-0BP1
(04.96 Edition)

/BAH/
SINUMERIK 840D/810D
Operator's Guide HT6 (HPU new)
Order No.: 6FC5 298-0AD60-0BP0
(06.00 Edition)

/BAK/
SINUMERIK 840D/810D/FM-NC
Short Operation Guide
Order No.: 6FC5 298-5AA10-0BP0
(12.98 Edition)

/BAM/
SINUMERIK 840D/810D
Operator's Guide ManualTurn
Order No.: 6FC5 298-5AD00-0BP0
(02.00 Edition)

/KAM/
SINUMERIK 840D/810D
Short Guide ManualTurn
Order No.: 6FC5 298-2AD40-0BP0
(11.98 Edition)
B References

/BAS/
SINUMERIK 840D/810D
Operator's Guide ShopMill
Order No.: 6FC5 298-5AD10-0BP1
(11.99 Edition)

/KAS/
SINUMERIK 840D/810D
Short Guide ShopMill
Order No.: 6FC5 298-2AD30-0BP0
(01.98 Edition)

/BAP/
SINUMERIK 840D/840Di/810D
Operator's Guide Handheld Programming Unit
Order No.: 6FC5 298-5AD20-0BP1
(04.00 Edition)

/BNM/
SINUMERIK 840D/840Di/810D/FM-NC
User's Guide Measuring Cycles
Order No.: 6FC5 298-5AA70-0BP2
(04.00 Edition)

/DA/
SINUMERIK 840D/840Di/810D/FM-NC
Diagnostics Guide
Order No.: 6FC5 298-5AA20-0BP2
(04.00 Edition)

/PG/
SINUMERIK 840D/840Di/810D/FM-NC
Programming Guide Fundamentals
Order No.: 6FC5 298-5AB00-0BP2
(04.00 Edition)

/PGA/
SINUMERIK 840D/840Di/810D/FM-NC
Programming Guide Advanced
Order No.: 6FC5 298-5AB10-0BP2
(04.00 Edition)

/PGK/
SINUMERIK 840D/810D/FM-NC
Short Guide Programming
Order No.: 6FC5 298-5AB30-0BP0
(12.98 Edition)

/PGZ/
SINUMERIK 840D/840Di/810D/FM-NC
Programming Guide Cycles
Order No.: 6FC5 298-5AB40-0BP2
(04.00 Edition)

/PI /
PCIN 4.4
Software for Data Transfer to/from MMC Module
Order No.: 6FX2 060 4AA00-4XB0 (German, English, French)
Order from: WK Fürth

/SYI /
SINUMERIK 840Di
System Overview
Order No.: 6FC5 298-5AE40-0BP0
(06.00 Edition)
Manufacturer/Service Documentation

a) Lists

/LIS/ SINUMERIK 840D/840Di/810D/FM-NC SIMODRIVE 611D Lists Order No.: 6FC5 297-5AB70-0BP2 (04.00 Edition)

b) Hardware


/EMV/ SINUMERIK, SIROTEC, SIMODRIVE EMC Installation Guide Planning Guide (HW) Order No.: 6FC5 297-0AD30-0BP1 (06.99 Edition)

/PHC/ SINUMERIK 810D Manual Configuring (HW) Order No.: 6FC5 297-3AD10-0BP2 (04.00 Edition)

/PHD/ SINUMERIK 840D NCU 561.2-573.2 Configuring Manual (HW) Order No.: 6FC5 297-5AC10-0BP2 (04.00 Edition)

/PHF/ SINUMERIK FM-NC NCU 570 Configuring Manual (HW) Order No.: 6FC5 297-3AC00-0BP0 (04.96 Edition)

/PMH/ SIMODRIVE Sensor Measuring System for Main Spindle Drives Configuring/Installation Guide, SIMAG-H (HW) Order No.: 6SN1197-0AB30-0BP0 (05.99 Edition)
c) Software

/FB1/

SINUMERIK 840D/840Di/810D/FM-NC
Description of Functions, Basic Machine (Part 1) (04.00 Edition)
(the various sections are listed below)
Order No.: 6FC5 297-5AC20-0BP2

A2 Various Interface Signals
A3 Axis Monitoring, Protection Zones
B1 Continuous Path Mode, Exact Stop and Look Ahead
B2 Acceleration
D1 Diagnostic Tools
D2 Interactive Programming
F1 Travel to Fixed Stop
G2 Velocities, Setpoint/Actual-Value Systems, Closed-Loop Control
H2 Output of Auxiliary Functions to PLC
K1 Mode Group, Channel, Program Operation Mode
K2 Axes, Coordinate Systems, Frames, Actual-Value System for Workpiece, External Zero Offset
K4 Communication
N2 EMERGENCY STOP
P1 Transverse Axes
P3 Basic PLC Program
R1 Reference Point Approach
S1 Spindles
V1 Feeds
W1 Tool Compensation

/FB2/

SINUMERIK 840D/840Di/810D(CCU2)/FM-NC
Description of Functions, Extended Functions (Part 2) (04.00 Edition)
including FM-NC: Turning, Stepper Motor
(the various sections are listed below)
Order No.: 6FC5 297-5AC30-0BP2

A4 Digital and Analog NCK I/Os
B3 Several Operator Panels and NCUs
B4 Operation via PG/PC
F3 Remote Diagnostics
H1 Jog with/without Handwheel
K3 Compensations
K5 Mode Groups, Channels, Axis Replacement
L1 FM-NC Local Bus
M1 Kinematic Transformation
M5 Measurement
N3 Software Cams, Position Switching Signals
N4 Punching and Nibbling
P2 Positioning Axes
P5 Oscillation
R2 Rotary Axes
S3 Synchronous Spindles
S5 Synchronized Actions (up to and including SW 3)
S6 Stepper Motor Control
S7 Memory Configuration
T1 Indexing Axes
W3 Tool Change
W4 Grinding

/FB3/

SINUMERIK 840D/840Di/810D(CCU2)/FM-NC
Description of Functions, Special Functions (Part 3) (04.00 Edition)
(the various sections are listed below)
Order No.: 6FC5 297-5AC80-0BP2
F2 3-Axis to 5-Axis Transformation
G1 Gantry Axes
G3 Cycle Times
K6 Contour Tunnel Monitoring
M3 Coupled Motion and Leading Value Coupling
S8 Constant Workpiece Speed for Centerless Grinding
T3 Tangential Control
V2 Preprocessing
W5 3D Tool Radius Compensation
TE1 Clearance Control
TE2 Analog Axis
TE3 Master-Slave for Drives
TE4 Transformation Package Handling
TE5 Setpoint Exchange
TE6 MCS Coupling

/FBA/

SIMODRIVE 611D/SINUMERIK 840D/810D
Description of Functions, Drive Functions (04.00 Edition)
(the various sections are listed below)
Order No.: 6SN1 197-0AA80-0BP6
DB1 Operational Messages/Alarm Reactions
DD1 Diagnostic Functions
DD2 Speed Control Loop
DE1 Extended Drive Functions
DF1 Enable Commands
DG1 Encoder Parameterization
DM1 Calculation of Motor/Power Section Parameters and Controller Data
DS1 Current Control Loop
DU1 Monitors/Limitations

/FBAN/

SINUMERIK 840D/SIMODRIVE 611D Digital
Description of Functions
ANA-Module (11.99 Edition)
Order No.: 6SN1 197-0ABB0-0BP0

/FBD/

SINUMERIK 840D
Description of Functions Digitizing (07.99 Edition)
Order No.: 6FC5 297-4AC50-0BP0
DI1 Start-up
DI2 Scanning with Tactile Sensors (scancad scan)
DI3 Scanning with Lasers (scancad laser)
DI4 Milling Program Generation (scancad mill)
/FBDN/ CAM Integration DNC NT-2000
Description of Functions
System for NC Data Management and Data Distribution (10.99 Edition)
Order No.: 6FC5 297-5AE50-0BP0

/FBFA/ SINUMERIK 840D/810D
Description of Functions
ISO Dialects for SINUMERIK (04.00 Edition)
Order No.: 6FC5 297-5AE10-0BP1

/FBHLA/ SINUMERIK 840D/SIMODRIVE 611 digital
Description of Functions
HLA Module (08.99 Edition)
Order No.: 6SN1 197-0AB60-0BP1

/FBMA/ SINUMERIK 840D/810D
Description of Functions ManualTurn (02.00 Edition)
Order No.: 6FC5 297-5AD50-0BP0

/FBO/ SINUMERIK 840D/810D/FM-NC
Description of Functions Configuring of Operator Interface OP 030 (03.96 Edition)
Order No.: 6FC5 297-3AC40-0BP0
BA Operator's Guide
EU Development Environment (Configuring Package)
PS Online only: Configuring Syntax (Configuring Package)
PSE Introduction to Configuring of Operator Interface
IK Screen Kit: Software Update and Configuration

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– Reference Manual: Module Data
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SIMATIC S7-300 Manual: STEP 7, Basic Information, V. 3.1
Order No.: 6ES7 810-4CA02-8AA0

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Order in conjunction with Configuring Package

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FM 354 Servo Drive Positioning Module
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SIMATIC S7-300
FM 357 Multi-Axis Module for Servo and Stepper Drives
Order in conjunction with Configuring Package

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Order No.: 6SN 1197-4MA00-0BP0

SIMODRIVE 611-A/611-D, SimoPro 3.1
Program for Configuring Machine-Tool Drives
Order No.: 6SC6 111-6PC00-0AA
Order from: WK Fürth

d) Installation and start-up

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Installation and Start-Up Guide
Order No.: 6SN 1197-0AA60-0BP5

SIMODRIVE 611D
Installation and Start-Up Guide (incl. description of SIMODRIVE 611D start-up software)
Order No.: 6FC5 297-3AD20-0BP2

SIMODRIVE 640D/SIMODRIVE 611D
Installation and Start-Up Guide (incl. description of SIMODRIVE 611D start-up software)
Order No.: 6FC5 297-5AB10-0BP2

SIMODRIVE FM-NC
Installation and Start-Up Guide
Order No.: 6FC5 297-3AB00-0BP0

MMC Installation and Start-Up Guide
Order No.: 6FC5 297-5AE20-0BP2

IM1 Start-up functions for the MMC 100.2
IM3 Start-up functions for the MMC 103
IM4 Start-up functions for HMI Advanced (PCU 50)
HE1 Editor help
BE1 Supplement operator interface
Note

An extract from the EC Declaration of Conformity No. E002 V 25/02/99 is shown below. A complete copy of the EC Declaration of Conformity can be found in the "EMC Installation Guidelines" for the SINUMERIK, SIROTEC and SIMODRIVE controls.
EG-Konformitätserklärung
EC Declaration of Conformity

No. E002 V 25/02/99

Hersteller: Siemens AG

Manufacturer:

Anschrift: Siemens AG A&D MC

Address: Frauenauracherstraße 80

91056 Erlangen

Produkt- bezeichnung: SINUMERIK 805, 805SM-P, 805SM-TW, 810, 810D

820, 840C, 840CE, 840D, 840DE, FM NC

Product description SIMATIC FM 353, FM 354, FM 357

SIROTEC RCM1D, RCM1P

SIMODRIVE 610, 611A, 611D, 611U, MCU, FM STEPDRIVE

Das bezeichnete Produkt stimmt in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender Europäischer Richtlinie überein:
The product described above in the form as delivered is in conformity with the provisions of the following European Directives:

89/336/EWG Richtlinie des Rates zur Angleichung der Rechtvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit

(geändert durch 91/286/EEC, 92/31/EWG, 93/68/EWG und 93/97/EWG).


(amended by 91/286/EEC, 92/31/EWG, 93/68/EEC and 93/97/EEC)

Die Einhaltung dieser Richtlinie setzt einen EMV-gerechten Einbau der Produkte gemäß EMV-Aufbauregeln für SINUMERIK, SIROTEC, SIMODRIVE (Best. Nr. 6FC 5297-0AD30-0AP0) in der Gesamtanlage voraus. Anlagenkonfigurationen, bei der die Einhaltung dieser Richtlinie nachgewiesen wurde, sowie angewandte Normen, siehe:

For keeping the directive, it is required to install the products according to "EMC Mounting regulation for SINUMERIK, SIROTEC, SIMODRIVE" (Order No. 6FC 5297-0AD30-0AP0). For details of the system configurations, which meet the requirements of the directives, as well as for the standards applied see:

- Anhang A1 - A14 (Anlagenkonfigurationen)
- Anhang B1 - B7 (Komponenten)
- Anhang C (Normen)
- Anhang A1 - A14 (system configurations)
- Anhang B1 - B7 (components)
- Anhang C (standards)

Siemens AG
Erlangen, den 25.02.1999

R. Müller
Entwicklungslleitung

Name, Funktion Unterschrift
Name, function signature

K. Krause
Qualitätsmanagement

Name, Funktion Unterschrift
Name, function signature


This declaration certifies the conformity to the specified directives but contains no assurance of properties. The safety documentation accompanying the product shall be considered in detail.

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SINUMERIK 840D/SIMODRIVE 611 Description of Functions ANA Module (FBANA) – 02.00 Edition
A9: Typical plant configuration
SINUMERIK 840D/SIMODRIVE 611 with digital set-point interface

Note:
The plant configuration sketch illustrates only the basic measures to be implemented in a typical plant configuration to ensure compliance with Directive 89/336/EEC. In addition, especially in cases where the plant configuration deviates from this typical model, the installation guidelines for EMC plant design in the product documentation and the EMC installation guidelines for SINUMERIK, SIROTEC and SIMODRIVE (order no.: 6FC5297-0AD30-0BP0) must be noted and implemented.

*) with I/RF module and UE module 28 kW
**) filter in module group or separately

- All components which are designated in the Ordering Information as approved for operation in a combined SINUMERIK 840D / SIMODRIVE 611D installation comply with Directive 89/336/EEC when operated in an installation of this type.
- For compliance with standards, see Appendix C
Appendix C to EC Declaration of Conformity No. E002 V 25/02/99

C: The compliance of the products with Council Directive 89/336/EEC has been verified through inspection and testing in accordance with the following product standard, basic technical specifications and the basic standards contained therein. Product categories SINUMERIK, SIROTEC, SIMPDRIVE and SIMATIC are subject to the requirements of different standards.

C1 Product categories SINUMERIK*, SIMATIC, SIROTEC:

<table>
<thead>
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<th>Subject of tests:</th>
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<td>EN 50081-2 dated 8/93</td>
<td>1) Radio interference</td>
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<td>EN 55011</td>
<td>2) Radio interference</td>
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<td>EN 50082-2 dated 3/95</td>
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<td>EN 61000-4-3</td>
<td>4) Radiated radio frequency field (amplitude-modulated)</td>
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<td>EN 50204</td>
<td>5) Radiated radio frequency field (pulse-modulated)</td>
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<td>EN 61000-4-6</td>
<td>6) Conducted disturbances</td>
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<td>EN 61000-4-8</td>
<td>7) Power frequency magnetic fields</td>
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<td>EN 61000-4-2</td>
<td>8) Electrostatic discharge</td>
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<td>EN 61000-4-4</td>
<td>9) Electrical fast transient bursts</td>
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*) except for SINUMERIK 810D

C2 Product categories SIMODRIVE, SINUMERIK 810D:

Product standard: EN 61800-3

C3 Other standards complied with:

<table>
<thead>
<tr>
<th>1) VDE 0839 Part 81-2</th>
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<td>7) VDE 0847 Part 4-8, IEC 1000-4-8</td>
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<td>8) VDE 0847 Part 4-2, EN 60801 Part 2, IEC 801-2, VDE 0843 Part 2</td>
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<td>4) VDE 0847 Part 4-3</td>
<td>9) VDE 0843 Part 4, VDE 0847 Part 4-4, IEC 801-4</td>
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