Advant® OCS
with Master software

Advant® Controller 160

Version 2.1

Product Guide

3BSE 014 721R401

Use of **DANGER**, **WARNING**, **CAUTION**, and **NOTE**

This publication includes, **DANGER**, **WARNING**, **CAUTION**, and **NOTE** information where appropriate to point out safety related or other important information.

DANGER Hazards which could result in severe personal injury or death

WARNING Hazards which could result in personal injury

CAUTION Hazards which could result in equipment or property damage

NOTE Alerts user to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all **DANGER**, **WARNING**, and **CAUTION** notices.

TRADEMARKS

NOTICE

CE MARKING

This product meets the requirements specified in EMC Directive 89/336/EEC and in Low Voltage Directive 72/23/EEC and 93/68/EEC.

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Chapter 1 Overview

1.1 Introduction

Advant Controller 160 is a scalable highly modular controller used within Advant OCS system for general applications which require high availability and redundancy.

It is offering a full complement of control and communication functions and meets high requirements concerning performance, reliability and safety for burner management, safety systems, turbine control etc. through redundancy for all central components.

Advant Controller 160 is designed to work stand alone as well as an integrated part of the Advant OCS system to suit a wide range of applications.

The following key words summarize the philosophy of the system:

- Integration
- Distribution
- Reliability
- Openness
- User Friendliness
- Investment Security and Expandability

Figure 1-1 demonstrates a typical system configuration with Advant Controller 160 only.

One example of an Advant OCS system configuration including Advant Controller 160 is shown in Figure 1-2.

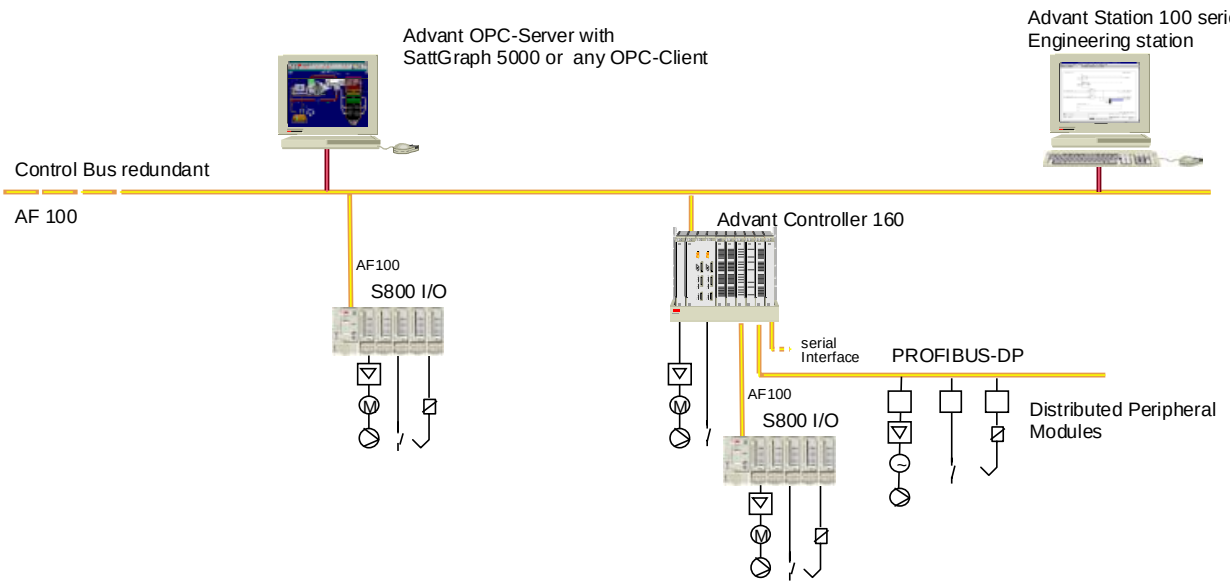

Figure 1-1. Typical System Layout, for Protection Applications

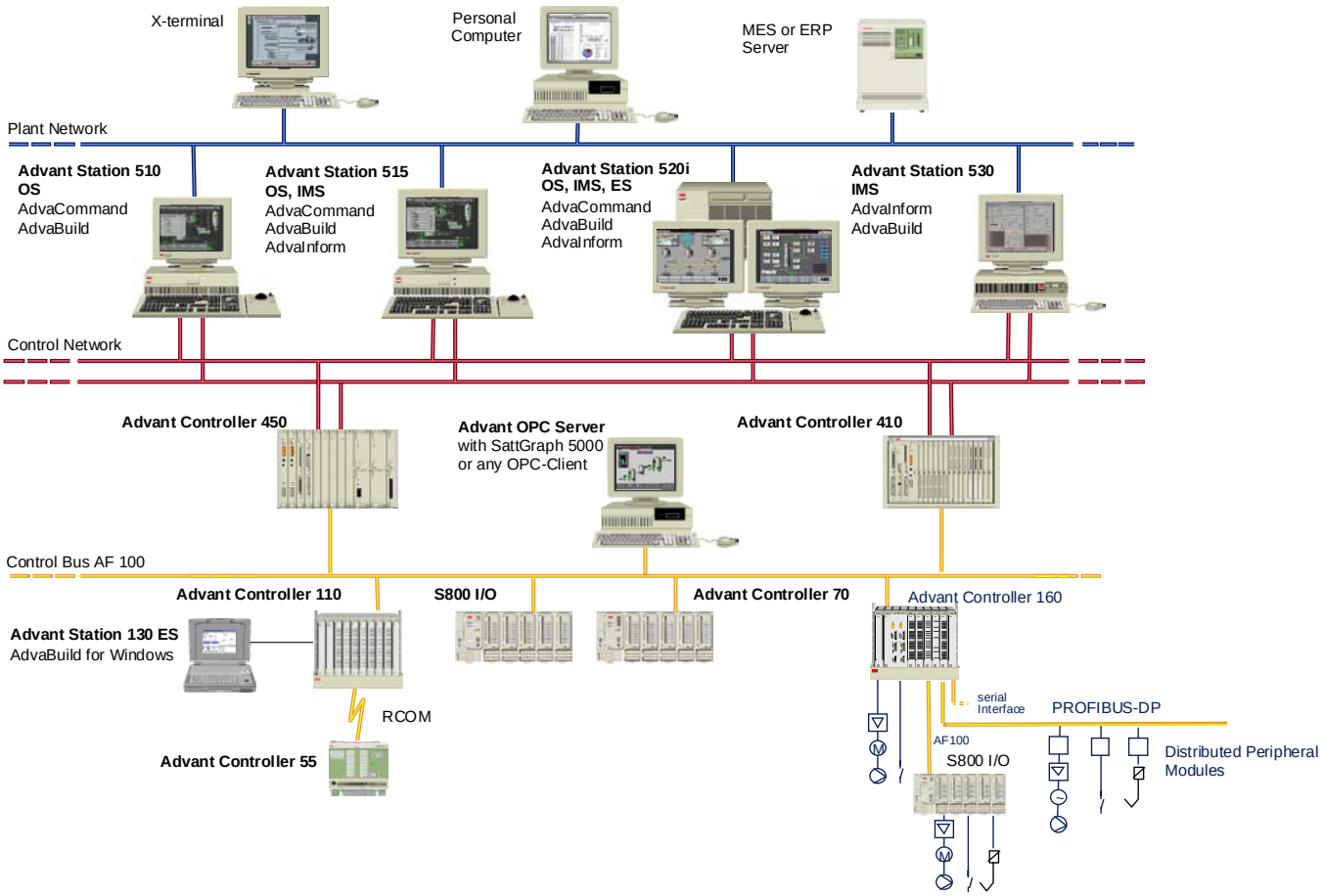

Figure 1-2. Advant OCS System Configuration with Advant Controller 160

1.2 Features

1.2.1 General

Advant Controller 160 offers powerful features covering all aspects of process control. The following are examples of control functions provided by the system:

- Logic and sequence control
- Regulatory control
- Supervisory control
- Positioning
- Counting, calculations and process optimization
- Sequences
- Recording of alarms and events

- Process interfacing
- Open interface to other systems
  - via standard serial interfaces, such as MODBUS and Siemens 3964R
  - via OPC for Advant Fieldbus 100
  - Interface to PROFIBUS-DP
  - Support for SERCOS and Interbus
- Password protection for application
- Password protection for Engineering Station access to the controller

1.2.2 Performance, Reliability, and Safety

Advant Controller 160 meets high requirements concerning performance, reliability and safety for burner management, safety systems and turbine control through

- multiprocessing
- redundancy for all central components
- multi-channel controller configurations
- hot replacement of all modules
- self diagnostics

1.2.3 Process Interface

Advant Controller 160 communicates with the process through various types of sensors and actuators connected to process interface units, or input/output (I/O) units.There are I/O units which can be placed directly in an Advant Controller 160 rack or units to be used at remote locations. The following signal types are supported:

- Analog Inputs
  - Isolated and non-isolated inputs. Standard voltage (0 to 10 V, 0 to ±20 mA), Pt 100 and thermocouple inputs.
- Analog Outputs
  - Isolated standard voltage or current outputs.
- Digital Inputs
  - Isolated and non-isolated 24 to 60 V d.c., 24 to 250 V a.c./d.c, with SOE capabilities.
- Digital Output
  - Isolated and non-isolated 24 to 60 V d.c., 24 to 250 V a.c./d.c., transistor and relay outputs.
- Pulse Counters
  - Isolated, 5 V, 24 V d.c. or ±13 mA, max 100 kHz.

1.2.4 Operator interfaces

1.2.4.1 SattGraph 5000 Operator Station with Advant OPC Server

SattGraph 5000 is an ABB SCADA (Supervisory Control and Data Acquisition) system based on Windows NT 4.0.

For interaction between operator and process it provides an HMI (Human Machine Interface), based on process graphics including information zooming, multiple windows and handling for control operations, events, alarms and historical value recording.

SattGraph 5000 and Advant Controller 160 communicate via OPC Server for Advant Fieldbus 100. This software is an ABB product that provides a standard OPC interface to connect any OPC Client (also third party products) to Advant Fieldbus 100 and thus establishes access to Advant Controller 160.

1.2.4.2 AdvaSoft 2.0 for Windows NT with Advant OPC Server

AdvaSoft 2.0 for Windows NT is an Operator Station based on Windows NT 4.0.

For interaction between operator and process it provides an HMI (Human Machine Interface), based on process graphics including information zooming, multiple windows and handling for control operations, events, alarms and historical value recording.

Advasoft 2.0 and Advant Controller 160 communicate via OPC Server for Advant Fieldbus 100. This software is an ABB product that provides a standard OPC interface to connect any OPC Client (also third party products) to Advant Fieldbus 100 and thus establisher access to Advant Controller 160.

1.2.4.3 Advant Station 500 Operator Station

Within Advant Station 500 Operator Station (AS 500OS) all process objects are operated by dynamic function keys which pop up by just clicking on the symbol of the object, e.g., a pump, in the process display. Additionally to the buttons for process operation these keys provide a wide range of functions as acknowledgement, alarm blocking, limit and parameter setting, etc.

AS 500OS supports binary history and archiving as well as retrieval.

1.2.5 Engineering

1.2.5.1 Advant Station 100 Series Engineering Station

Advant Station 100 Series Engineering Station (AS 100ES) is a ready to use system and includes everything necessary for configuration and programming of Advant Controllers.

AS 100ES is an PC-based programming and service tool suitable for use in industrial environment and satisfying the Advant OCS environmental immunity specifications and safety standards. It supports program entry, testing, documentation and fault tracing. It also features graphical function chart programming and a user interface with windows, pull-down menus and “point and click” selection.

The software Control Builder A (CBA) installed on Advant Station 100 Series Engineering Stations is offering the following main functions:

- Application data administration with Application Builder.
- System and application configuration of Advant Controller 400 Series, MasterPiece 200/1, MasterGate 230/1, Advant Station 500 Series Operator Station, and MasterView 800/1 by On-line Builder.
- Application configuration of Advant Controller 400 Series and MasterPiece 200/1 process stations off-line using Function Chart Builder.
- Application configuration and commissioning, including fault tracing of Advant Controller 100 Series on-line and off-line by Function Chart Builder.
- Configuration support for AF 100 OPC by Bus Configuration Builder.

Advant Station 100 Series Engineering Board is needed for command execution and serves as an interface between Advant Station 100 Series Engineering Stations and target systems of type Advant Controller 400 Series.

For more detailed information see:

- *Advant Station 100 Series Engineering Station User's Guide*
- *AMPL Configuration Advant Controller 100 Series Reference Manual*
- *Application Builder User's Guid*e.
- *Function Chart Builder User's Guide*
- *Bus Configuration Builder User's Guide*
- *PROFIBUS Library Editor User's Guide*

1.2.5.2 Control Builder A

Control Builder A (former name: AMPL Control Configuration) includes all software necessary to configure Advant OCS. It is delivered on CD-ROMs and includes:

- Application Builder
- Function Chart Builder
- Bus Configuration Builder.

As options are available:

- On-line Builder
- AMPL PC and DB Element Libraries including libraries for:
  - Advant Controller 100 Series
  - Advant Controller 400 Series
  - MasterPiece 200/1
  - AdvaSoft.

NOTE

To work with Function Chart Builder, at least one AMPL PC or DB Element Library must be installed. Further AMPL PC and DB Element Libraries are available from various Business Units and other ABB companies for application specific extensions of controllers.

Control Builder A 1.0 supports Advant Controller 160 version 2.1 in two target variants:

1. Target "**AC 160 with PM64x 2.1**" for Processor Modules PM640, PM644, PM645, or PM646.
2. Target "**AC 160 with PM66x 2.1**" for the new Power PC based Processor Module PM665.

These two targets will be available in Application Builder as soon as the option AC160 AMPL Libraries 3.0 is being installed on your system.

Chapter 2 Software Functions

2.1 Process Control Software

Process control applications are programmed in the ABB Master Programing Language (AMPL). The building blocks of AMPL are called PC elements which covers a wide range of functions.

The Engineering Stations support type circuits; standard solutions to control problems in an application area or in a specific application project. A type circuit may comprise all the functions to control motors, pumps, valves, temperature loops, etc., including all the necessary definitions for I/O and operator communication. It can be tested and corrected before it is multiplied. This means optimization of engineering work by using standard solutions.

2.1.1 AMPL

AMPL is a function-block language with graphic representation, which is especially oriented towards process control. The function blocks offer a high level of configurability from simple to complex. The language is common for all controller products within Advant Power System and Advant OCS.

The general description is given within the Advant OCS Product Guide with the same chapter number.

2.1.2 PC Elements

For Advant Controller 160 a comprehensive library of PC elements is available (Table 2-1). Chapter 4.3.1 shows in which options they can be found.

Table 2-1. PC Elements for Advant Controller 160

Type	PC Elements
Structure Elements	PCPGM, CONTRM, FUNCM, MASTER, SLAVEM, BLOCK, SEQ [1], STEP [1], GRC, P_STEP
Logic	AND, OR, XOR, INV, AND-TRG, OR-TRG, ADD-MR, THRESH-L, SR, SR-D, SR-AA, SR-AO, SR-OA, SR-OO, AND-O, OR-A, BGET, BSET
Arithmetic	ADD, SUB, MUL, DIV, ABS, SQRT, LIM-N, ADD-MR, DIV-MR, MULDIV
Time	MONO, MONO-UT, TON, TOFF, TON-RET, TRIGG, OSC-B, TIMER
Registers	FIFO, MOVE, REG, REG-G, REG-G-UT, SHIFT
Multiplexers	MUX-I, MUX-MI, MUX-MN
Code Converters	CONV, CONV-BI, CONV-IB

Table 2-1. PC Elements for Advant Controller 160 (Continued)

Type	PC Elements
Counters	COUNT
Comparators	COMP-B, COMP-I, COMP-R, COMP-B, MAX, MIN
Switches	SW, SW-C
Measurement Elements	RSM [2]
Signal Selector	MOON
Function Generator	FUNG-1V
Filter	FILT-1P
Feedback	P-1, INT, DER, PI, PID, PIP, PDP, CON-PU1, RAMP
Redundancy	MOVERED, TRAC, SW-RED, RED_STAT
PROFIBUS	PB-IN, PB-OUT
Protection and Safety	PC_AX646, CONV-AX, PC_DX610, SYS-CRC
Supervision	SYSL, SYSTIME

1 SEQ and STEP cannot be used with redundant processing (CPU or station redundancy). Instead GRC and P_STEP can be used.
2 RSM cannot be used with PM646.

2.1.3 Data Base Elements

The following Data Base elements are available for Advant Controller 160 version 2.1

Table 2-2. DB Elements for Advant Controller 160

Type	DB Elements
Processor Modules	PM640, PM644, PM645, PM646[1], PM665[2]
High speed link	HSLR, HSLS, MDAT(IL), MDAT(NB), MDAT(NI), MDAT(R)
S600 I/O	CI610, CI615, AI610, AI620, AI625, AI630, AI635, AO610, AO650, AX645, AX646, DI610, DI620, DI621, DI622, DI635, DI636, DI650, DI651, DI652, DI685, DO610, DO620, DO625, DO630, DX610, DP620, DP640
S800 I/O	CI810, CI820, AI801, AI810, AI820, AI830, AI835, AO801, AO810, AO820, DI801, DI810, DI811, DI814, DI820, DI821, DI885, DO801, DO810, DO814, DO815, DO820, DO821

Table 2-2. DB Elements for Advant Controller 160 (Continued)

Type	DB Elements
HSI	DAT_AI, DAT_AO, DAT_DAT, DAT_DI, DAT_DO
Advant Fieldbus 100	AF100S, CI626, CI627, CI630, CI631, DSP, DAT(B), DAT(I), DAT(II), DAT(IL), DAT(R)
Multi Vendor Interface	SC610, CI532, MVICHAN, MVINODE, MVB, MODCHAN, PARDAT(B), PARDAT(I), PARDAT(II), PARDAT(IL), PARDAT(R), PARDAT(NB), PARDAT(NI), PARDAT(T), PARDAT(TR)
PROFIBUS-DP	PB, PBS, CI830, PB_ACS600, *S800 I/O* [3]
Event Handling	AIC, DIC, EVS(S), EVS(T)
S600 I/O	AX645, AX646, DX610
Extended DB Elements	AIS, AOS, DIS, DOS, MB, MI, MIL, MR

1 PM640, PM644, PM645, PM646 are only available when target “AC 160 with PM64x 2.1” is selected in Control Builder A.
2 PM665 is only available when target “AC 160 with PM66x 2.1” is selected in Control Builder A.
3 S800 DB elements starting with PB_... connected via CI830.

Chapter 3 Hardware Functions

3.1 Controller Hardware

The hardware of Advant Controller 160 consists of Processor Modules, Communication Interface modules, Submodule Carrier, I/O modules with process connectors, subracks, cable ducts and power supplies.

Subracks and cable duct are designed for wall mounting or mounting in cabinets. Normally they are mounted in cabinets.

The modules are housed in a sheet-steel enclosure which protects the circuit boards. The enclosure has openings at the top and bottom for air convection. It meets the IP20 protection class of IEC 529.

3.1.1 Processor Modules

Six different types of Processor Modules are available for Advant Controller 160:

1. Processor Module PM640 for non redundant processing.
2. Processor Module PM644 for non redundant processing with PROFIBUS-DP master interface on the Processor Module.
3. Processor Module PM645 (type B) for parallel processing with data exchange via high speed link and with rotational speed signal input onboard.
4. Processor Module PM646 for redundant processing with additional hardware and software monitoring functions required for safety application systems.
5. Processor Module PM665. Same features as PM645, but based on Motorola Power PC microprocessor, with more RAM and approximately sixfold better performance.

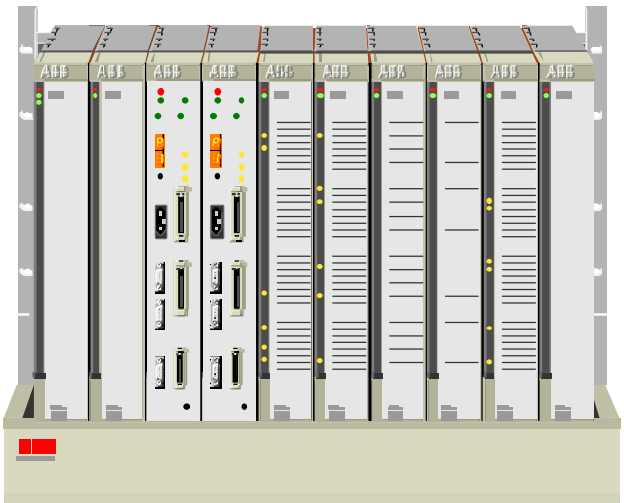

Figure 3-1. Advant Controller 160, Controller Subrack

Processor Module PM640

- Processor Module PM640 uses a Motorola MC68360 processor, 1 MByte nonvolatile memory (Flash PROM) for user built applications and 2 Mbyte nonvolatile memory (Flash PROM) for the system software, and 2 MBytes SRAM. At start-up the application is copied from the nonvolatile memory into the SRAM memory where it is executed. The memory is not expandable.
- PM640 has two RS 232-C ports at 9,600 Baud dedicated for connection of an Advant Station 100 Series Engineering Station and for connecting a local Operator Station via MODBUS I protocol.

Processor Module PM644

Processor Module PM644 has all features of PM640 as described above plus the following ones:

- Processor Module PM644 contains a second Motorola MC68360 processor with extra 2 MByte nonvolatile memory (Flash PROM) for the system software and extra 2.25 MByte SRAM for PROFIBUS communication.
- Processor Module PM644 has a PROFIBUS-DP master interface with RS 485 port for data exchange with PROFIBUS slaves.
- PM644 additionally contains two rotational speed signal input ports of type RS-422.

Processor Module PM645 (type B)

The Processor Module PM645 (type B) has all features of PM640 as described above, plus the following ones:

- A second Motorola MC68360 processor with extra 512 kbyte nonvolatile memory (Flash PROM) for the system software and extra 2 MByte SRAM.
- Two RS-422 ports (high-speed-serial-links) for signal and data exchange between Processor Modules for application and system purposes.
- A redundancy voter for dual and triple redundancy.
- Two rotational speed signal input ports RS-422.

Processor Module PM646

Processor Module PM646 has all features of a PM640 as described above, plus the following ones:

- Processor Module PM646 contains a second Motorola MC68360 processor with extra 2 MByte nonvolatile memory (Flash PROM) for the system software and 2 MByte SRAM.
- The 2 MBytes SRAM is extended with a secondary 2 MBytes SRAM (Mirror-RAM) for a redundant data storage with a hardware-based data comparison.
- Processor Module PM646 contains two RS-422 ports (high-speed-serial-links) for signal and data exchange between Processor Modules for application and system purposes.

- Processor Module PM646 additionally contains a redundancy voter for dual and triple redundancy.
- Both printed circuit boards of PM646 contain a watchdog circuit with outputs combined for triggering the on-board relay (Implementation of an independent “Second Shutdown Path” for safety systems).
- Processor Module PM646 has an extended 5 V power supply supervision with under- and overvoltage detection.

Processor Module PM665

- The Processor Modules PM665 uses a Motorola MPC8240, a member of the Power PC microprocessor family, with 1 MByte nonvolatile memory (Flash PROM) for user built applications and 2 Mbyte nonvolatile memory (Flash PROM) for the system software, and 64 MBytes SDRAM. At start-up the application is copied from the nonvolatile memory into the SDRAM memory where it is executed.
- PM665 has all features of PM645B as described above. In addition
  - both RS 232-C ports can operate at 116 kBaud.
  - port **Com A** is dedicated for connecting an Advant Station 100 Series Engineering Station and for loading the communication software and system software.
  - port **Com B** is equipped with full modem signals for connecting a local Operator Station or panel via MODBUS I protocol. **Com B** uses a **male** 9 pin connector.

3.1.2 Interface Module Carrier

The purpose of the submodule carrier is to carry communication interfaces. Each Advant Controller 160 can accommodate one SC610 submodule carrier module. Note that an SC610 can only be operated with a PM640, a PM644, a non redundant PM645, a PM646, or with a PM645B, PM646, or PM665 in station redundancy.

Table 3-1. Submodule Carrier

Consists of	Description
SC610	Submodule Carrier, required for CI532. Two submodules fit into one carrier; one SC610 per controller is allowed.

3.1.3 Communication Interfaces

Communication interfaces are designed as modules or submodules. A submodule is a small board which fits into a slot on the submodule carrier, SC610. Modules can be exchanged while

the system is running. New modules can also be inserted live. Every unit has a red LED to indicate fault.

Table 3-2. Communication Interfaces

Consists of	Description
CI532V01	RCOM/RCOM+ communication. Each interface holds two buses.
CI532V02	MODBUS communication. Each interface holds two buses.
CI532V03	Siemens 3964(R) communication. Each interface holds two buses.
CI590[1]	SERCOS interface.
CI626	Advant Fieldbus 100, coaxial cable.
CI627	Advant Fieldbus 100, twisted pair cable.
CI630	Advant Fieldbus 100, coaxial cable, redundant coupling with 2 interface modules.
CI631	Advant Fieldbus 100, twisted pair cable, redundant coupling with 2 interface modules.
CI680[1]	Interbus S.

1 Distributed by CHIND – BU Printing.

3.1.4 Subrack

The 10-position controller subrack, RF616, is the primary subrack of an Advant Controller 160. It provides dedicated positions for Processor Modules, communication and bus extender modules.

There is a two-digit thumb wheel switch for setting the station address. The individual module address is given by its position in the subrack.

The bus connector links the controller subrack to an optional extension subrack via a bus cable (TK612).

The 10-position extension subrack, RF620, extends the number of I/O modules of a station.

The individual module address is given by its position in the subrack.

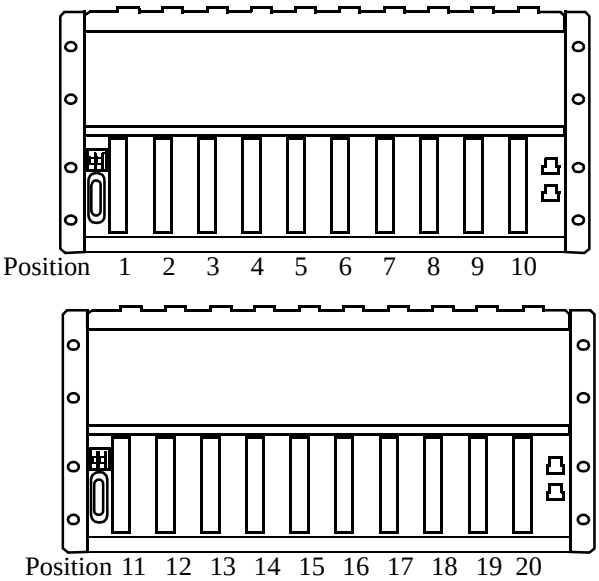

Figure 3-2. Basic Subrack RF616 and Extension Subrack RF620

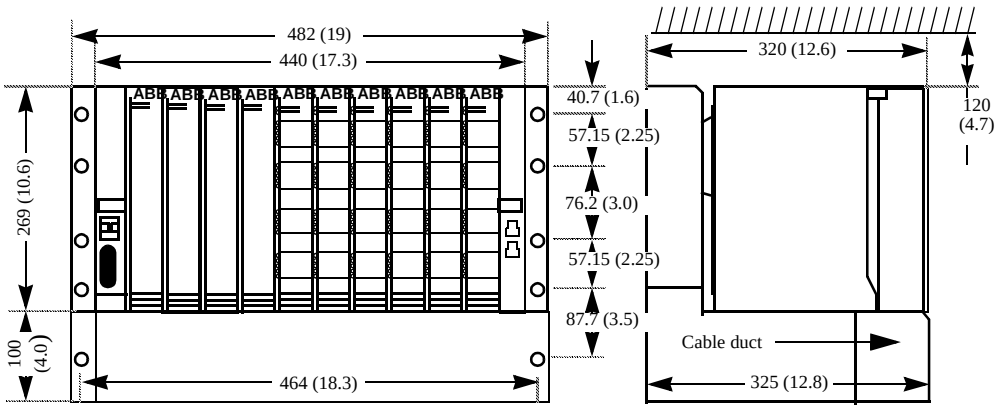

Figure 3-3. Physical Layout of Subrack and Cable Duct

3.1.5 Cable Duct

The cable duct RC610 holds the process cables. It also provides 10 screw terminals for connecting the cable shields of process cables to ground.

3.1.6 Power Supply

Advant Controller 160 can be connected to the following types of primary supply:

- 120 V or 230 V a.c., 47 to 450 Hz, using the power supply module SA610.
- 110 V/125 V or 220 V/250 V d.c., using the power supply module SA610.
- 24 V d.c., direct supply to Advant Controller 160 from an external power supply.

The electronic circuits of the modules are fed by means of two redundant power rails. The 0 V level is connected to the metallic part of the subrack.

Table 3-3. Station Voltage Specifications

Description	Value
Nominal voltage	24 V d.c.
Acceptable voltage range	19.2 to 30 V d.c.
EMI protection level	None (station voltage must be filtered)

The use of the power supply module SA610 is recommended. SA610 is housed in the standard module enclosure and occupies one position in the subrack. SA610 provides reinforced primary voltage isolation, excellent EMI filtering and buffering of short (10 ms for 110 V d.c. input and 20 ms for 230 V a.c. input) primary voltage drop out. If one SA610 is not sufficient, two can be used in parallel within one subrack, i.e., up to four modules SA610 within one station (basic station or I/O station).

Advant Controller 160 can be powered from an external 24 V d.c. power source (i.e. without SA610). Special attention must be paid to grounding and noise level. An EMI filter must be used, and the negative pole of the supply be grounded in the metallic part of the subrack.

All available power supply solutions are listed in the reference guide.

3.2 Input/Output Hardware

3.2.1 S600 Local I/O

The S600 I/O system consists of I/O modules with typically 16 or 32 input or output channels, depending on the type of module. The I/O modules are placed in I/O stations which are built up by one or two I/O subracks. I/O modules can also be inserted into the controller subrack.

The general description of the I/O system is given within the Advant OCS Product Guide with the same chapter number.

The following chapter contains specific information for Advant Controller 160.

3.2.1.1 I/0 Station with Redundant Bus Extension

For Advant Controller 160 the I/O bus extension can be configured for redundancy with two CI615 interface modules and two extension bus lines. This configuration provides increased system reliability compared to non redundant I/O bus extension.

Each I/O station connected to both extension bus lines contains two bus extenders, CI610, which must be put in position 1 and 2.

Table 3-4. Bus Extender Modules

Consists of	Description
CI610	Bus extender module for I/O station
CI615	Bus extender module for Basic Station

The maximum bus cable length of each bus line is 20 m (65 ft.).

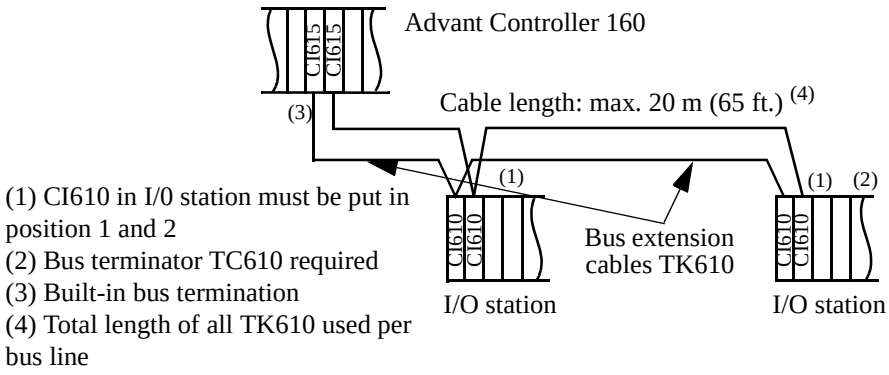

Figure 3-4. Configuration of I/O Stations for AC 160 with Redundant Bus Extension

The I/O stations may be mounted in the same or in adjacent cabinets. The stations must be connected to a common ground; the voltage difference at the ground terminals must be less than ± 2 volts.

The bus extension cable TK610 can be delivered in lengths of 2.5, 5 and 10 m (6.6, 16.4 and 32.8 ft.). The above figure shows the configuration with redundant bus extension.

The table below specifies the equipment used to build up I/O stations with redundant bus extensions.

Table 3-5. I/O units with Redundant Bus Extension

Units	Description
Subrack RF615, Cable duct RC610 and two Bus extenders CI610.	I/O station with redundant bus extender.
Subrack RF620, Cable duct RC610, Bus cable TK612 and Power cable TK615.	I/O extension kit.
2× (Bus extenders CI615 for base station and Bus terminators TC610 for I/O extension bus).	2× I/O bus extension kit.
RC620	I/O Fan unit 24 V.

3.2.2 S800 Distributed I/O

The S800 I/O is a distributed I/O for Advant Controller 110, Advant Controller 160, and Advant Controller 450 via Advant Fieldbus 100. S800 I/O is also used as a directly connected I/O to Advant Controller 70.

The S800 I/O system consists of I/O modules with typically 4, 8 or 16 input or output channels, depending on the type of module.

The I/O station is connected to Advant Fieldbus 100 via a redundant or non redundant Fieldbus Communication Interface (FCI).

The *S800 I/O System General Information and Installation User's Guide* gives more details about these modules. The *S800 I/O Product Guide* gives a first overview.

The following S800 I/O modules are supported:

Table 3-6. S800 I/O Modules Supported by Advant Controller 160

Module type	Type designation
CI	CI810, CI820, CI830
AI	AI801, AI810, AI820, AI830, AI835
AO	AO801, AO810, AO820
DI	DI801, DI810, DI811, DI814, DI820, DI821, DI885
DO	DO801, DO810, DO814, DO815, DO820, DO821

3.3 Field Communication Hardware

3.3.1 Advant Fieldbus 100

Advant Fieldbus 100 (AF 100) is a high performance fieldbus which is used for communication between Advant Controllers and Advant Stations.

The general description is given within the Advant OCS Product Guide with the same chapter number.

Each Advant Controller 160 supports up to 4 independent AF 100 buses. The following chapter contains more specific information.

Communication Interfaces for Advant Controller 160

With Advant Controller 160 the following Communication Interfaces and modems can be used:

- CI630, CI626 and CI626V1 for coaxial cable.
- TC630 for conversion between coaxial and optical cable.
- TC513 for conversion between coaxial and twisted pair.
- CI631, CI627 for twisted pair cable.
- TC514 for conversion between twisted pair and optical cable.
- TC515 for repeating twisted pair to twisted pair.

NOTE

- Up to 4 independent Advant Fieldbus 100 can be connected. For increased availability, CI630 or CI631 can be used as redundant pairs (altogether 8 couplers).
- If CI630 and/or CI626 and/or CI631 and/or CI627 are used, media redundancy is fully supported.
- If CI626 is used: Coaxial media redundancy only is supported, with restrictions in cable length difference between the two redundant cables. With optical bus cable, only one physical bus line is possible.

CI630 and CI631 supervise if each Data Set to be sent via Advant Fieldbus 100 is cyclically updated by the Processor Modules. In case of missing update CI630, CI631 stops sending the respective Data Sets which is automatically detected by each receiving node.

Supported Configurations

Advant Controller 160 supports the following Advant Fieldbus 100 configurations:

- Communication with Advant Controller 70, 110, 160, 450, SattGraph 5000, AdvaSoft 2.0 Operator Station with OPC Server (Figure 3-5 to Figure 3-7).
- Coaxial, twisted pair and optical bus cables (Figure 3-5 to Figure 3-7).
- Redundant bus cables (Figure 3-5 to Figure 3-7).
- Redundant Communication Interfaces to Advant Fieldbus 100 (Figure 3-5).
- Second Advant Fieldbus 100 with redundant Communication Interface to communicate with S800 I/O stations and subordinate Advant Controller 70, 110 or 160 (Figure 3-7).

When redundant media are used, redundancy must be maintained through the whole bus; this comprises bus lines as well as connections of nodes to the bus.

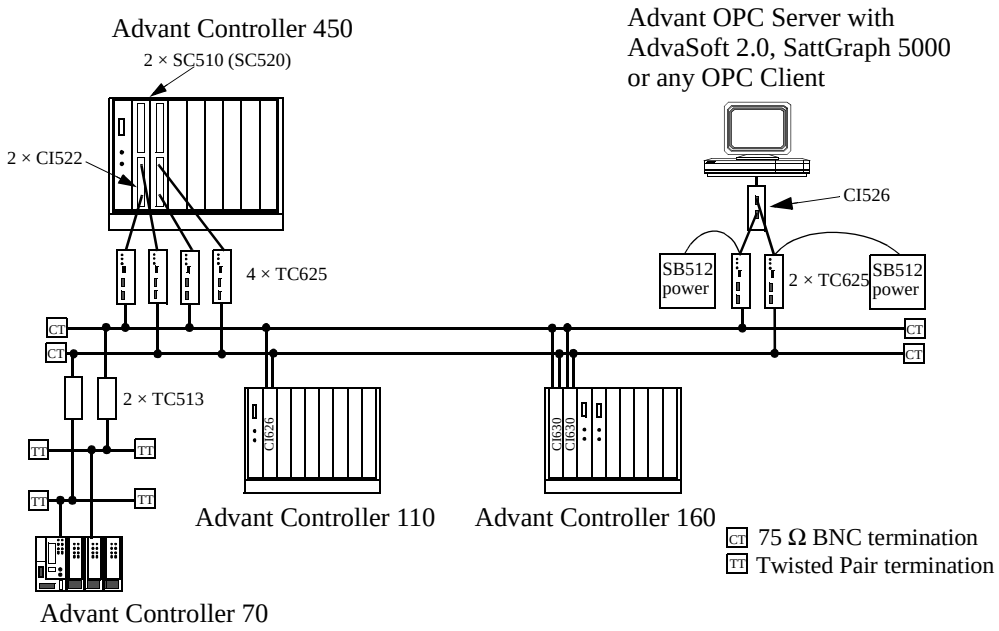

Figure 3-5. Redundant Advant Fieldbus 100 Configuration Using Coaxial Media

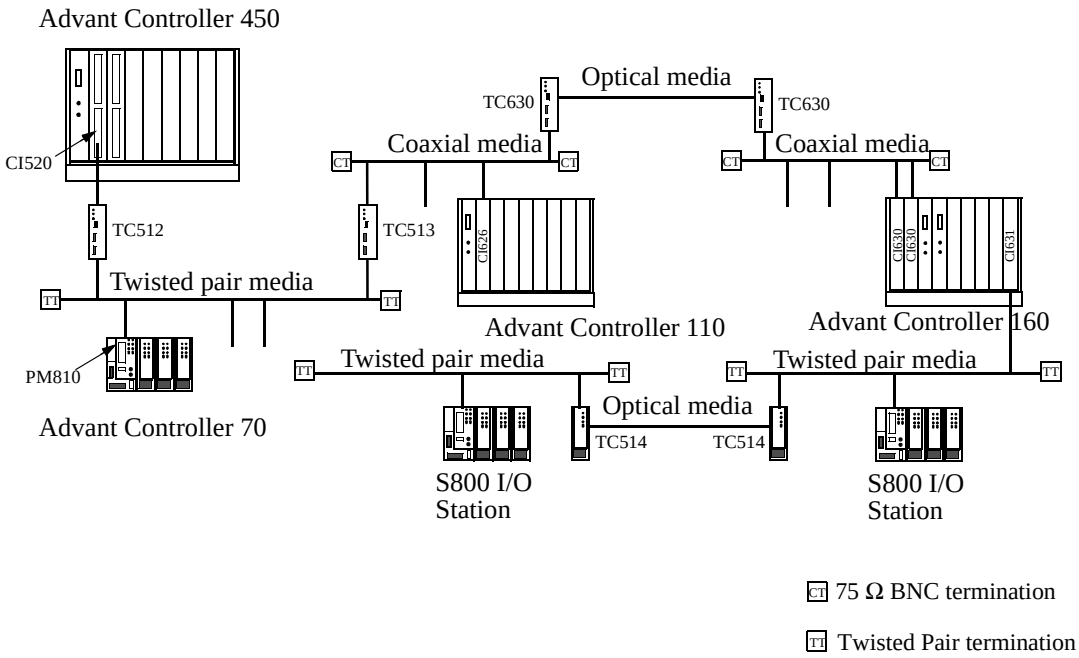

Figure 3-6. Media Conversion in Advant Fieldbus 100

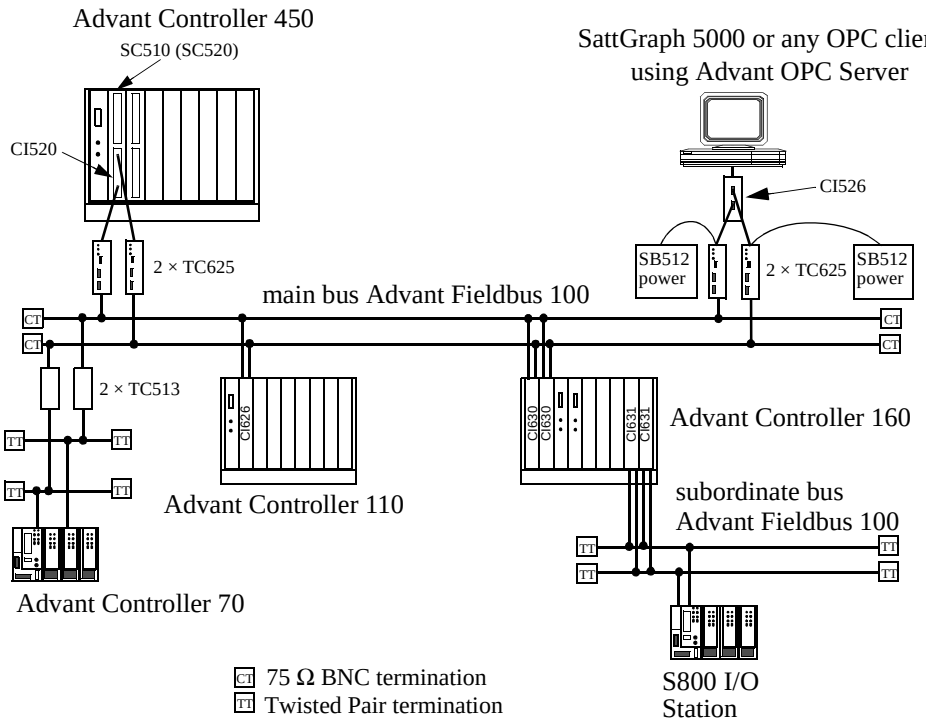

Figure 3-7. Dual Advant Fieldbus 100 Configuration

3.3.2 PROFIBUS-DP

PROFIBUS is a high performance fieldbus which is used for communication between Advant Controllers and PROFIBUS slaves (PROFIBUS DPMs, **D**istributed **P**eripheral **M**odules). Therefore the PROFIBUS variation PROFIBUS-DP (**D**ecentralized **P**eriphery) is used.

The PROFIBUS-DP interface in Advant Controller 160 allows to connect PROFIBUS slaves. It conforms with the PROFIBUS-DP standard EN 50170 and a subset of the extensions known as PROFIBUS-DPV1.

Communication Interface for Advant Controller 160

Traffic on a PROFIBUS link is controlled by a master station. Direct communication is possible only between the master and the slaves.

In Advant Controller 160, the Communication Interface within Processor Module PM644 is a PROFIBUS-DP master class 1.

S800 I/O and ACS600 Standard Drives can be connected to Advant Controller 160 using the Communication Interface CI830 which acts as PROFIBUS-DP slave.

Dimensioning

In Advant Controller 160, PROFIBUS can be configured as follows:

- Communication with up to 125 PROFIBUS-DP slaves per PROFIBUS, via twisted pair bus cables according to EN 50170 (Figure 3-8).
- Up to 32 devices (master or DPMs or repeaters) per cable segment.
- Cable segment length up to 1,200 m.
- Up to 244/244 input/output bytes process data per PROFIBUS slave.
- Up to 236 input diagnostic data bytes per PROFIBUS slave.
- Transmission speed from 9,600 Baud up to 12 MBaud.
- Up to 6 Processor Modules PM644 can be used in an Advant Controller 160.
- It is recommended to use only certified PROFIBUS-DP slaves

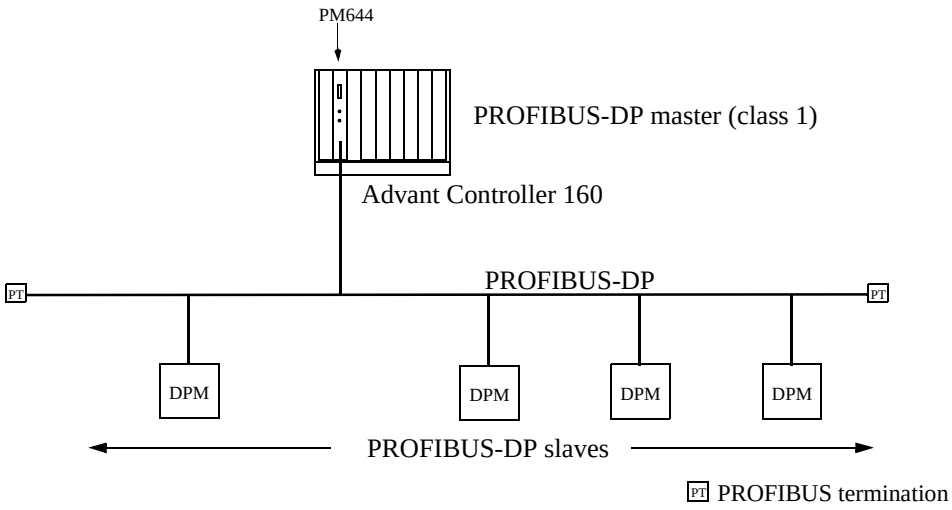

Figure 3-8. Sample PROFIBUS Configuration

PROFIBUS Configuration in Control Builder A

A PROFIBUS-DP configuration consists of two parts:

6. The standardized part of PROFIBUS-DP master implemented by the Processor Module (PM644) with the integrated PROFIBUS-DP interface
7. The variable part of PROFIBUS slaves implemented by different vendors. The latter are described by their GSD file.

In Control Builder A

- The PROFIBUS-DP master and the PROFIBUS-DP slave devices as types are represented

by DB element types.

- The PROFIBUS-DP master and the PROFIBUS-DP slave devices are represented by DB element instances.

When you are working with Control Builder A, the following tools and resources are available to produce a PROFIBUS-DP DB element library which reflects the actual PROFIBUS-DP slaves, modules, and signals as applicable:

- Model element library containing only the description of the PROFIBUS master and a compact slave, the later serving as template
- PROFIBUS Library Editor that allows to extend the model element library with the description of actual PROFIBUS slaves, modules, and signals.

The DB elements types created with the PROFIBUS Library Editor can be instantiated with the Function Chart Builder of your Advant Controller applications.

In the next figure the hierarchy of the DB elements is shown:

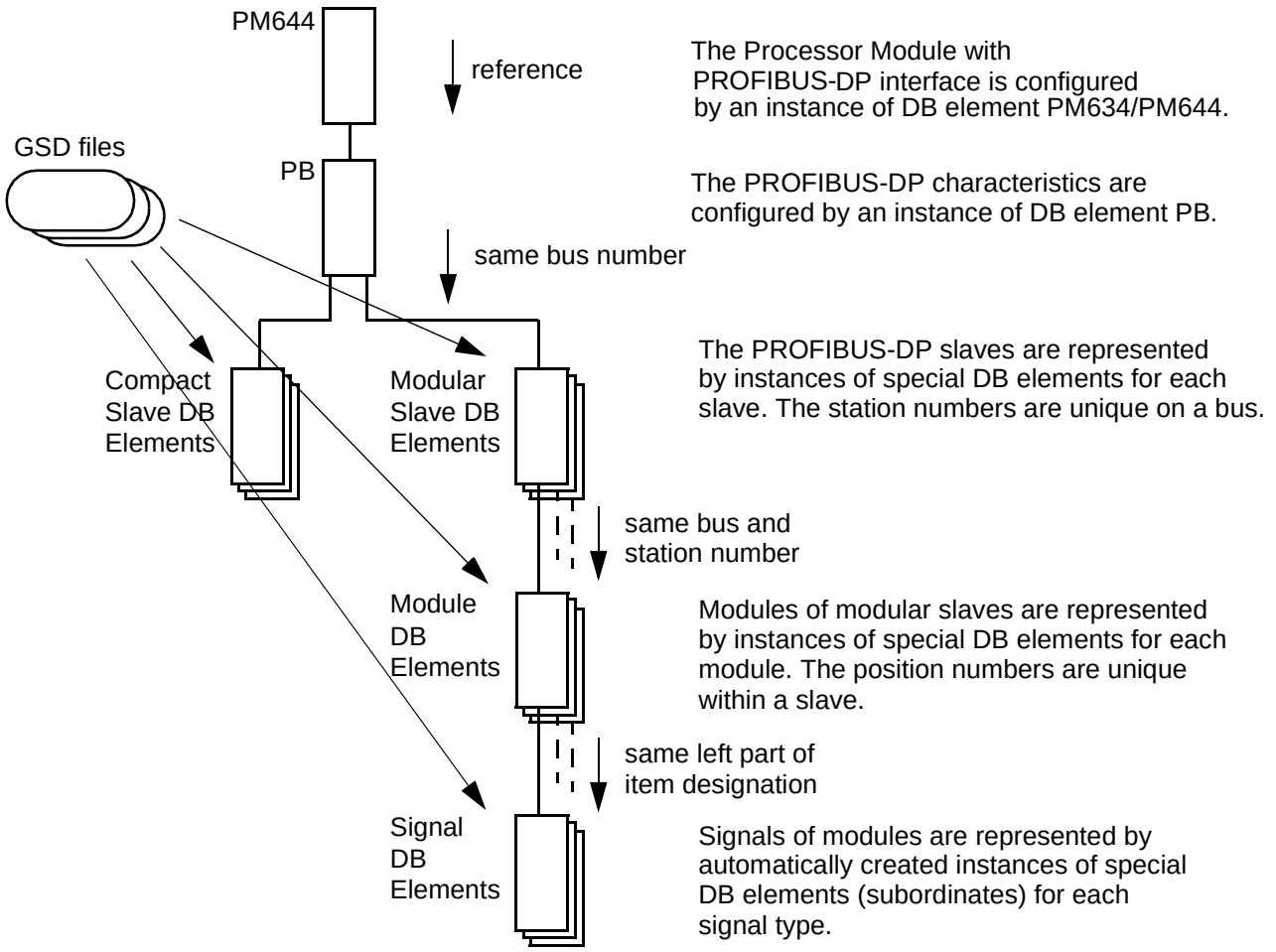

Figure 3-9. Hierarchy of DB Elements for PROFIBUS-DP Configurations

Chapter 4 Advant Controller 160 Configurations

4.1 Configuration Overview

ABB's Advant Controller 160 is a high performance modular controller for logic and regulatory control with redundancy. Advant Controller 160 and its S600 local I/O, S800 distributed I/O, or PROFIBUS-DP I/O can be used stand-alone or it can communicate with other controllers. Communication with Advant Controller 400 Series is possible via Advant Fieldbus 100 and RCOM. Communication with external PLCs is possible via MODBUS and Siemens 3964R protocol.

The controller is specifically designed for high speed PLC-type applications, but it also brings considerable problem-solving power to all analog signal handling and arithmetic applications.

Advant Controller 160 covers a wide range of applications. As programming language AMPL is used. The function element library contains a complete set of functions. Application programs can be shared between Advant Controller 55, Advant Controller 70, Advant Controller 110, Advant Controller 160, and Advant Controller 400 Series, provided that a common set of AMPL elements is used.

Program entry, testing, documentation and fault tracing are supported by the Advant Station 100 Series Engineering Stations. These stations feature graphical Windows based function-chart programming and a user interface with multiple windows, pull down menus and "point-and-click" selection. Advant Controller 160 communicates with the engineering station through its standard serial interface or via Advant Fieldbus 100.

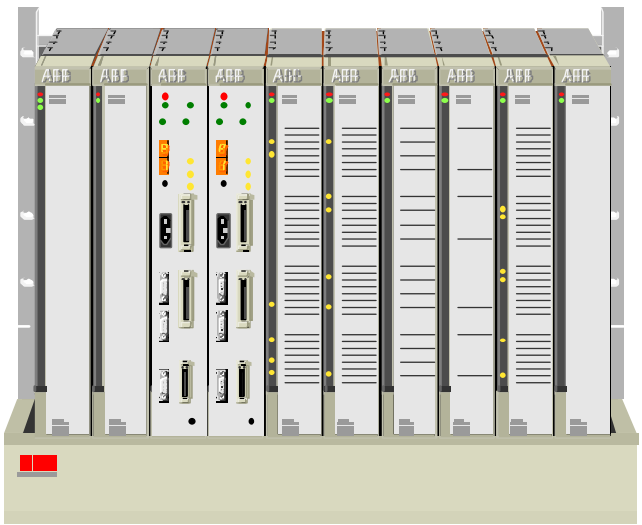

Figure 4-1. Advant Controller 160, Basic Unit

Advant Controller 160 is fully modular, with modules mounted in 19" subracks. The subracks are designed for mounting on the rear wall in a cabinet.

A minimal Advant Controller 160 configuration consists of one or two subracks containing the two redundant Processor Modules and up to 18 I/O and communication modules.

In order to extend the number of I/O modules, up to 7 I/O stations may be connected to the Basic Station, each consisting of up to two subracks.

To increase the numbers of I/Os, it is also possible to connect decentralized S800 I/O (Advant Fieldbus 100 via CI627/CI631) and decentralized PROFIBUS-DP I/O (PROFIBUS-DP via PM644), to the Advant Controller 160.

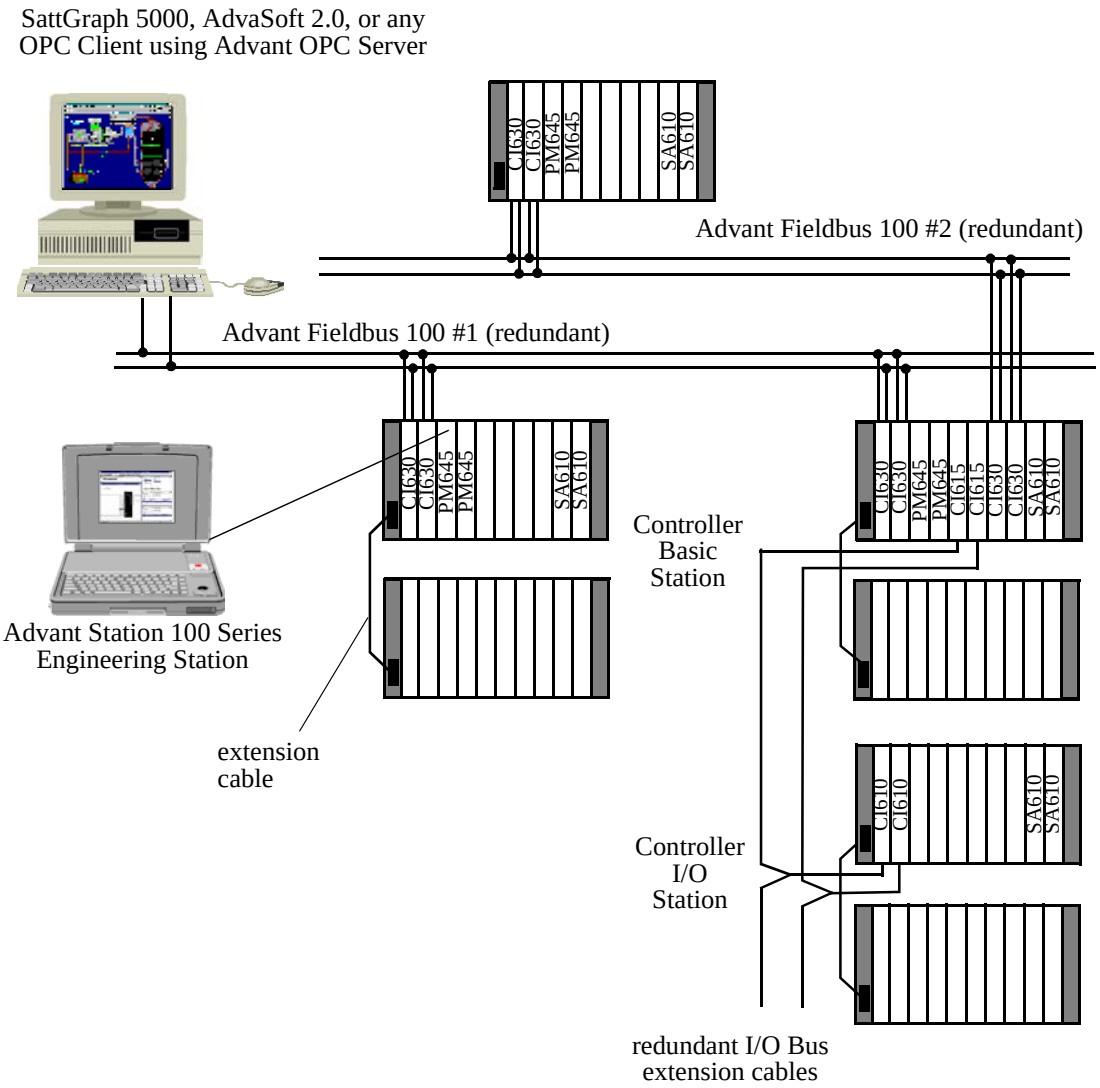

Figure 4-2. Advant Controller 160 System Structure, Redundant Configuration

For connection of a local operator station (3rd party product), the Processor Module of Advant Controller 160 is equipped with a MODBUS I serial interface.

SattGraph 5000 or AdvaSoft 2.0 for Windows NT Operator Stations using Advant OPC Server are easily connected via Advant Fieldbus 100.

Using dual redundant Processor Modules, dual redundant communication interface modules to Advant Fieldbus 100 and to I/O extension bus, dual redundant power supply modules and mains supplies an increased availability of the Advant Controller 160 can be achieved.

Advant Controller 160 is fully modular with use of subracks for all modules. The subracks can be installed in cabinets or can be mounted directly on the wall. All process connections can be made to screw terminals on connections units.

4.2 Preconditions and Restrictions

To support Advant Controller 160 version 2.1, **Control Builder A** version 1.0 or higher including Function Chart Builder 6.0 has to be used.

4.3 Product Components

The functional extent of Advant Controller 160 is determined by enabling or adding optional software modules and by adding hardware units to the Basic Unit.

All standard software options are built-in, some of them already enabled, others need to be enabled to achieve the desired functional configuration.

Custom made software modules (add-on options, see Section 4.3.1.7 System Software Extensions (Add-on Options)) can to be loaded to the Processor Module to add even more functionality.

Optional hardware units are additional Processor Modules, local or remote I/O, Communication Interface modules, etc.

4.3.1 Software Components

The system software for Advant Controller 160 is stored in one single program module. This program module consists of a BASE software providing the basic functionality plus several built-in options. These options can be combined in any way that is needed to solve the application task. A description of the basic functionality and all options is given below.

4.3.1.1 BASE Software Module

The contents of the PC element library in the BASE software module is shown in Table 4-1. The

Table 4-1. PC Elements in BASE Program Module

Type	PC Elements
Structure Elements	PCPGM, CONTRM, FUNCM, MASTER, SLAVEM, BLOCK, SEQ [1], STEP [1], GRC, P_STEP
Logic	AND, OR, XOR, INV, AND-TRG, OR-TRG, ADD-MR, THRESH-L, SR, SR-D, SR-AA, SR-AO, SR-OA, SR-OO, AND-O, OR-A, BGET, BSET
Arithmetic	ADD, SUB, MUL, DIV, ABS, SQRT, LIM-N, DIV-MR, MULDIV
Time	MONO, MONO-UT, TON, TOFF, TON-RET, TRIGG, OSC-B, TIMER
Registers	FIFO, MOVE, REG, SHIFT
Multiplexers	MUX-I, MUX-MI, MUX-MN
Code Converters	CONV, CONV-BI, CONV-IB
Counters	COUNT
Comparators	COMP-I, COMP-R, COMP-B, MAX, MIN
Switches	SW, SW-C
Redundancy	MOVERED [2], RED-STAT
PROFIBUS	PB-IN, PB-OUT
Protection	PC_AX646, CONV-AX, PC_DX610, SYS-CRC
Supervision	SYSL, SYSTIME

1 SEQ and STEP cannot be used with redundant processing (CPU or station redundancy). Instead GRC and P_STEP can be used.
2 MOVERED is used for planned recursions and for operator commands within application programs of redundant Processor Modules PM645, PM646, or PM665.

4.3.1.2 Option OPT1: Extended PC

The option “OPT1: Extended PC” extends the PC element library with a set of elements for regulatory control.

The contents is shown in Table 4-4.

Table 4-2. PC Elements in OPT1: extended PC

Type	PC Elements
Registers	REG-G, REG-G-UT
Function Generator	FUNG-1V
Filter	FILT-1P
Feedback	P-1, INT, DER, PI, PID, PIP, PDP, CON-PU1, RAMP

4.3.1.3 Option OPT2: MVI Handling

In conjunction with the MVI module CI532V01, V02 or V03, the option “OPT2: MVI Handling” extends the functionality of the controller with the following communication facilities.

1. RCOM/RCOM+
2. Siemens 3964(R)
3. MODBUS

NOTE

Option OPT2 is already enabled in the system software.

CAUTION

Use only one channel on the CI532Vxx board in slave mode.

4.3.1.4 Option OPT3: Events

Option “OPT3: Events” extends the functionality of Advant Controller 160 with event handling capabilities:

- Detection of events from digital or analog output terminals (calculated events)
- Handling of events from modules DI650, DI651, DI652, DI685, and DI885
- Event handling and event transfer via Advant Fieldbus 100
- Event handling via RCOM/RCOM+ (requires also OPT2)
- Time tagging of events
- Transit of events

OPT3 is already enabled in the system software of Advant Controller 160.

4.3.1.5 Option OPT4: Modbus I RTU

Option “OPT4: Modbus I RTU” extends the functionality of Advant Controller 160 with the MODBUS I protocol (RTU = binary mode), which is intended for communication with a PC

based local Operator Station or panel. Advant Controller 160 can be used **only as a slave** on MODBUS. Serial interface **Com B** of the Processor Module is used for this purpose.

The following MODBUS functions (read/write commands) are supported:

Table 4-3. Supported MODBUS functions

01 = Read coil status	06 = Load single register
02 = Read input status	07 = Read exception status
03 = Read holding register	08 = Diagnostic loop-back
04 = Read input register	15 = Force multiple coils
05 = Force single coil	16 = Load multiple registers

4.3.1.6 Option OPT6: St. Red. + RSM

Option “OPT6: St. Red. + RSM” extends the controller functionality with

- Station redundancy and
- Rotational speed measurement.

The contents of the PC element library in OPT6 is shown in Table 4-4.

Table 4-4. PC Elements in OPT6: St. Red. + RSM

Type	PC Elements
Measurement elements	RSM
Signal Selector	MOON
Redundancy	TRAC, SW-RED

4.3.1.7 System Software Extensions (Add-on Options)

Although the built-in options often bring great enhancement to the functionality, the need for customer-specific PC elements may arise to match business unit specific applications.

An extension—in this context—is a PC element or a group of PC elements embraced from a library that can be loaded to the controller to “extend” its capabilities. If description files for Control Builder A are added, we rather speak of customer specific add-on options.

In contrast to standard options, these add-on options are usually distributed on a diskette containing:

- the option loader,
- the binary image to be loaded to the controller,
- a batch file for loading the image file
- several description files for Control Builder A plus

- documentation.

The customer is able to apply the option to Advant Controller and Control Builder A himself. The loader “adds” the code to the Advant Controller’s system software during run-time.

The advantage is, that there is no need to modify the system software itself. Thereby, the only limitation for the number of add-on options is the available system FPROM memory of the processor module, respectively its RAM size.

The description files for Control Builder A are read and compiled by the Setup Add-ons Utility on the PC (for instance Advant Station 100 Series Engineering Station). An Add-on option may also be distributed together with complete PC program applications that make use of PC elements that are included in the option.

4.3.2 Hardware components

4.3.2.1 Basic Unit

The Basic Unit for Advant Controller 160 comprises the following components (Table 4-5):

Table 4-5. Basic Unit for Advant Controller 160, Components

Component	Description
RF616	Subrack.
RC610	Cable duct.
System Software	CD-ROM containing System Software, AMPL Libraries, documentation.

The basic subrack of the controller may consist of one or two subracks.

In accordance to the desired Advant Controller 160 functionality the Basic Unit may be equipped with a various number of the available Processor Modules and Communication Interfaces.

The following **rules** apply **for hardware configuration of the basic station of a controller**:

- The two subracks must be put in the same cabinet.
- The power supply terminals (USA, USB, ZD) of the two subracks must be linked. For EMI considerations, the subracks should be grounded with a 16 mm^2 copper lead.
- Up to six Processor Modules can be used within one Basic Unit.
- The Processor Modules must always be put in position 3 to 8 in the basic subrack
- At least one Communication Interface module CI626, CI627, CI630, or CI631 in position 2 is required within any Advant Controller 160 configuration—even if no Advant Fieldbus 100 communication is required.
- The Communication Interface module for the main Advant Fieldbus 100 must be put in position 2 (non redundant interface), or in position 1 and 2 (redundant interface) of the same subrack. Usable Communication Interfaces are CI630 or CI631 for non redundant or

redundant interface, CI626 or CI627 for non redundant interface only.

- The Communication Interface module for the subordinate Advant Fieldbus 100 must be put in position 9 or 10 (non redundant interface), in position 9 and 10 (redundant interface) of the same subrack. Usable Communication Interfaces are CI630 or CI631 for non redundant or redundant interface, CI626 or CI627 for non redundant interface only.
- One Submodule Carrier module per controller is supported. SC610 is not supported by dual redundant Processor Modules (CPU redundancy). It requires a single Processor Module or a Processor Module of type PM645B, PM646, or PM665 within station redundancy.
- If I/O stations are connected, the bus extender modules CI615 can be put in position 3...10 of the basic subrack.
- Up to two optional power supply modules SA610 per subrack can be put in position 9 and 10 (basic subrack) and 19 and 20 (extension subrack).

All modules can be replaced during system operation.

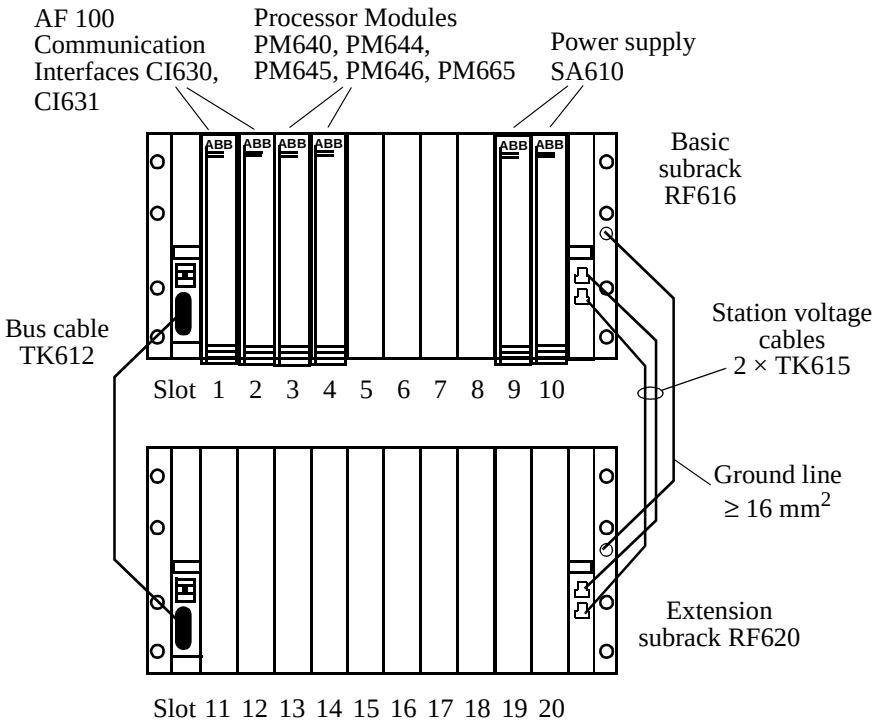

Figure 4-3. Advant Controller 160 with 2x PM, 2x CI, and 2x SA610

For the typical Advant Controller 160 applications the following Basic Unit controller configurations are essential:

- **Basic Unit with one Processor Module PM640** for non redundant processing.
- **Basic Unit with one Processor Module PM644** for non redundant processing with on-

board PROFIBUS-DP (master class 1) interface and on-board rotational speed signal input (e.g. for turbine control).

- **Basic Unit with one Processor Module PM645 (type B)** for dual or triple redundant processing with on-board redundancy voter and on-board rotational speed signal input (e.g. for turbine control).
  - For dual redundancy an additional Processor Module PM645B within the same station or in another station is necessary.
  - For triple redundancy two additional Processor Modules PM645B within different stations are necessary.
- **Basic Unit with one Processor Module PM646** for dual or triple redundant processing with on-board redundancy voter.
  - For dual redundancy an additional Processor Module PM646 within the same station or in another station is necessary.
  - For triple redundancy two additional Processor Modules PM646 within different stations are necessary.
- **Basic Unit with one Processor Module PM665** for dual or triple redundant processing with on-board redundancy voter and on-board rotational speed signal input (e.g. for turbine control).
  - For dual redundancy an additional Processor Module PM665 within the same station or in another station is necessary.
  - For triple redundancy two additional Processor Modules PM665 within different stations are necessary.

4.3.2.2 I/O systems

For Advant Controller 160 the S600 local I/O and the S800 distributed I/O systems are used. The maximum number of I/O signals for an Advant Controller 160 is 1,500. The actual CPU load depends on the configured cycle times for the application program.

S600 I/O System

A range of I/O modules is available, covering analog and digital signals of various types. In addition, there are modules for temperature measurement, pulse counting, position measurement and rotational speed measurement applications. The process signals are connected to the front of the I/O modules.

The controller may contain up to 75 I/O modules. All I/O modules may be exchanged during system operation. The process signals are disconnected by removing the front connector. A newly inserted module is automatically put into operation if the system identifies the module as being of the correct type and without faults. For further information about S600 I/O please refer to the S600 I/O section in the Input/Output Hardware section.

The *S600 I/O Hardware Reference Guide* and the *S600 I/O Hardware Advant Controller 160 Reference Guide* detail the various I/O modules available for Advant Controller 160.

- **Unused supervised inputs**

Unused supervised analog inputs of the Advant Controller 160 must be terminated with external resistors in order to avoid respective error detection and signalling by the Processor Modules.

- **Output set as predetermined**
  In case of a severe controller error the outputs can be set to predetermined values. This output set as predetermined guarantees integrity of the process in case of controller failures.
  Output set as predetermined can be configured with use of the relay outputs of the Processor Modules which are switched over in case of a severe error. Both an open and a closed contact are provided per Processor Module. E.g. the relay outputs can be used to switch off the external voltage for digital outputs if the Processor Module which controls theses outputs fails.

S800 I/O System

A range of I/O modules is available, covering analog and digital signals of various types. The I/O system can be mounted horizontally or vertically on standard DIN-mounting rails according to DIN EN50033–35×15. The process signals are connected via module termination units, which are acting as I/O module carrier.

An I/O station may have of up to 24 I/O modules. All I/O modules may be exchanged during system operation. A newly inserted module is automatically put into operation if the system identifies the module as being of the correct type and without faults.

The general description of the I/O system is given within the *Product Guide for Advant OCS with Master Software, Overview.*

- **Output set as predetermined**
  In case of a severe module error, the outputs can be set to predetermined values. This output set as predetermined guarantees integrity of the process in case of failures.

4.3.2.3 Communication

For communication with other Advant Controllers, Operator Stations, and Engineering Stations, Advant Controller 160 can be connected to Advant Fieldbus 100 using the Communication Interface module CI626, CI627, CI630, or CI631. Two Communication Interfaces of type CI630 or CI631 can be used for redundancy. For communication with subordinate Advant Controllers or S800 I/O two (redundant) communication interfaces CI630 or CI631 ore via one (non redundant) communication interface CI626, CI627, CI630, or CI631 can be used.

Table 4-6. Number of Buses Connected to Advant Controller 160

Bus type	Maximum number of buses		Maximum number of Communication Interfaces	
RCOM/RCOM+, CI532V01	4	total 4	2	total 2
MODBUS I, CI532V02	4		2	
Siemens 3964 (R), CI532V03	4		2	

Table 4-6. Number of Buses Connected to Advant Controller 160 (Continued)

Bus type	Maximum number of buses	Maximum number of Communication Interfaces
PROFIBUS-DP, PM644	6	6
Advant Fieldbus 100	4	2×4 (redundancy)

NOTE

For performance reasons only one channel on the CI532Vxx can be used if the module acts as slave.

4.3.2.4 Configurations for Increased Availability and Safety

Advant Controller 160 offers a wide range of configuration options for control system applications with high requirements concerning availability and safety.

For **high availability**—depending on the requirements—a single or even a double fault must be tolerated by the control system. I.e. the configured functions e.g., the control functions of a turbine must run without any interruption in case of a fault.

For **safety** a single or even a double fault must not impede a needed trip of the plant (e.g. a boiler or a turbine). Additionally for high availability usually it is required that a single fault must not activate a trip.

Availability can be increased through redundancy**.** Advant Controller 160 offers module redundancy for all central system components (communication modules, Processor Modules, power supply modules). For redundant signal I/O multiple I/O modules within separate controllers can be used.

Safety can be increased through the use of multiple safety channels working in parallel.

In the following paragraphs the redundant and parallel configurations supported by Advant Controller 160 and its Processor Modules are shown.

For more detailed information refer to the *Advant Controller 160 Users Guide*.

Configuration for Redundant Processing

The Processor Modules PM645B, PM646, and PM665 can be used for redundant processing: Two Processor Modules within one station and with common I/O modules, synchronization via high speed serial link (Figure 4-4).

For CPU redundancy Processor Modules PM645, PM646, or PM665 with Communication Interfaces CI630/CI631 must be used in order to avoid single point of failure, even if no Advant Fieldbus 100 communication is required.

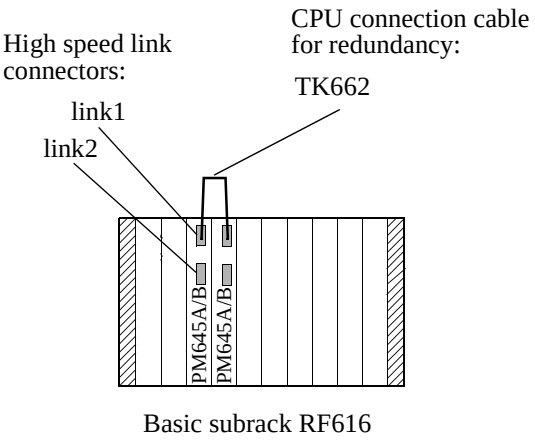

Figure 4-4. Dual redundant Processor Module within one Advant Controller 160

Configuration for Parallel Processing with External Voting

All Processor Modules can be used for parallel processing with external voting if the Processor Modules are allocated within one common station:

- **Dual parallel Processor Module**
  Two Processor Modules within one station with separate output modules and common set of input modules (Figure 4-5).
- **Triple parallel Processor Module**
  Three Processor Modules within one station with separate output modules and common set

of input modules (configuration not shown, similar to dual parallel Processor Module).

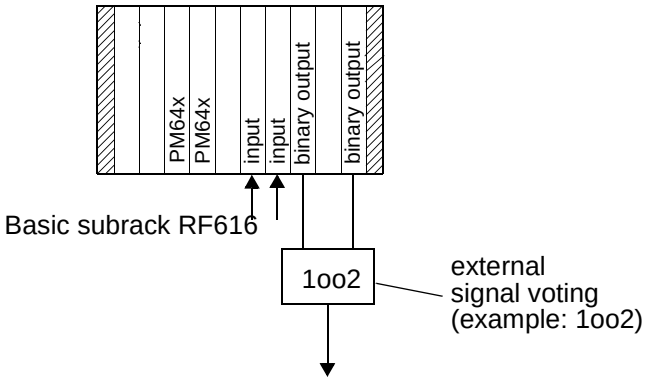

Figure 4-5. Dual Parallel Processor Module within one Advant Controller 160

The Processor Modules PM645C or PM646 can be used for parallel processing with external voting if the Processor Modules are allocated within separate stations:

- **Dual parallel station**
  Two Processor Modules within separate stations each with its own set of I/O modules, sensor signal exchange via high speed serial link (configuration not shown, similar to triple parallel station)
- **Triple parallel station**
  Three Processor Modules within separate stations each with its own set of I/O modules, sensor signal exchange via high speed serial link (Figure 4-6)

Dependent on the specific configuration **additional HW modules and cables for parallel processing** are needed:

- The parallel Processor Modules within different stations must be connected with one another via its high speed serial link interfaces. Therefore one connection cable set TK661 is to be used per connection.
- For configurations with parallel Processor Modules the output signals to be provided via two respectively three separate output modules must be voted externally. Therefore specific voter devices must be used.

For Turbine Protection of ABB Turbines, three solenoid valves with electro hydraulic 2oo3 voting is the standard solution.

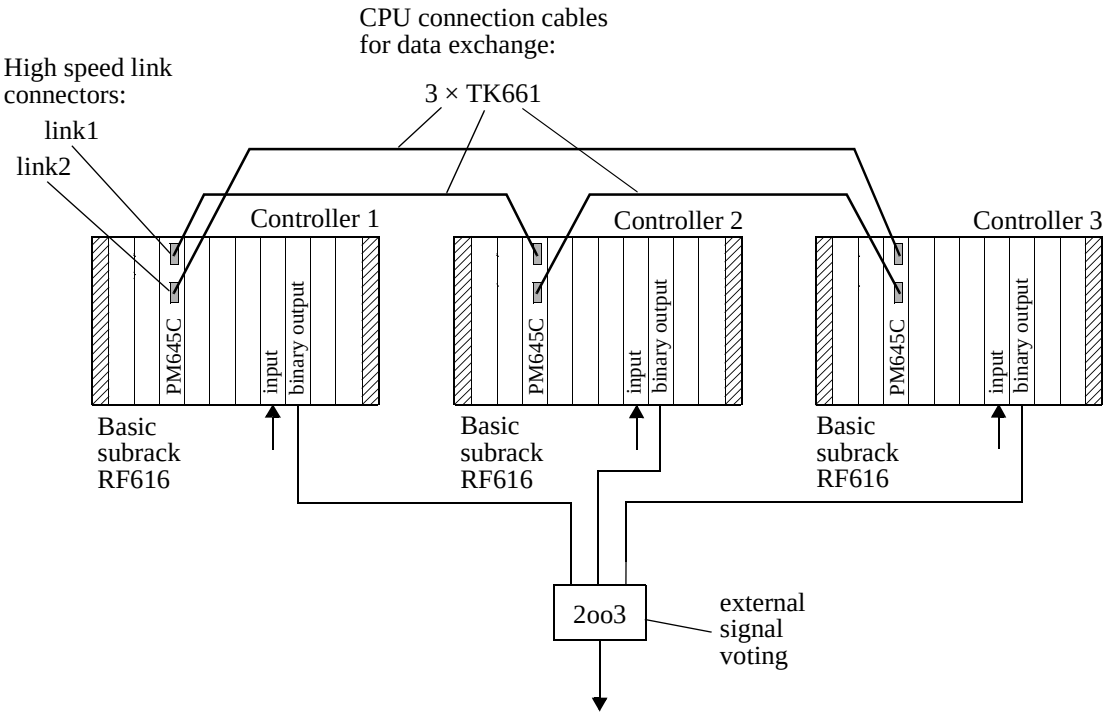

Figure 4-6. Triple Parallel Configuration with 3 Advant Controllers 160

4.3.2.5 System Clock Synchronization

Methods and System Components

Dependent on the specific system configuration using Advant Controller 160 different methods are available for synchronization of the system time:

- Time and date can be set via AS 100ES, AdvaSoft for Windows and can be downloaded to Advant Controller 160 at the same Advant Fieldbus 100. Advant Controller 450 can be loaded from AS 100ES via front connector.
- Clock synchronization via Advant Fieldbus 100 can be done by a controller which is configured as time master through sending the actual time as broadcast message once a second via Advant Fieldbus 100. Any Advant Controller 450[1] or Advant Controller 160 but only one can be configured as time master. The other controllers and the stations are time slaves, receive the time sent and update its internal clocks.
- External clock synchronization with use of a minute pulse input is supported for Advant

1. Advant Controller 450 can only be used as time master on Advant Fieldbus 100.

Controller 160 (with Processor Module PM645, PM646, PM665 via **I/O port**) and for Advant Controller 450. The minute pulse must be provided by a central clock, for example as output of a radio clock.

- External time signal using a DCF77 clock connected to the **Com B** serial line connector of the Processor Modules of Advant Controller 160.
- In case of missing synchronization the internal clocks of the controllers and stations provide the actual time with reduced accuracy.

Table 4-7 gives an overview on the controllers usable as time master for synchronization via Advant Fieldbus 100 with its used methods and needed system components for system time input and synchronization.

Table 4-7. System Time Masters for Synchronization via AF 100

System time master	System time input and synchronization for the time master
Advant Controller 450	Manual setting of time and date via AS 100ES[1] directly connected to Advant Controller 450 and external synchronization via minute pulse input of TC520.
Advant Controller 160	Manual setting of time and date via AS 100ES, AdvaSoft 2.0 for Windows NT and external synchronization via minute pulse input to PM645, PM646, PM665, or external synchronization via DCF77 time signal to all Processor Modules.

1 With option Online Builder and Engineering Board

Configurations

Two typical configurations as normally used for control systems are:

- Autonomous control system with Advant Controller 160 and Operator Station AdvaSoft 2.0 for Windows NT.

Control system with several Advant Controller 160 and superordinate Advant Controller 450 and Operator Stations Advant Station 500OS.

Autonomous Control System with Advant Controller 160 and AdvaSoft

The configuration is shown in Figure 4-7.

The Operator Station AdvaSoft 2.0 for Windows NT is time source, Advant Controller 160 on left is time master and can be synchronized via an external minute pulse. The other controllers are time slaves. The time master can contain a single Processor Module or dual or triple redundant Processor Modules or up to six Processor Modules for multiprocessing.

In case of redundant Processor Modules, the minute pulse is connected to each Processor Module. The active Processor Module is always the time master.

In case of single Processor Modules or station redundancy, the minute pulse is connected only to one Processor Module in one controller, which is the time master.

The time master sends time and date cyclically once a second as broadcast message. All other controllers receive these messages and set its internal clocks. Between two consecutive minute pulses the time master's internal clock runs independently ever providing the actual time.

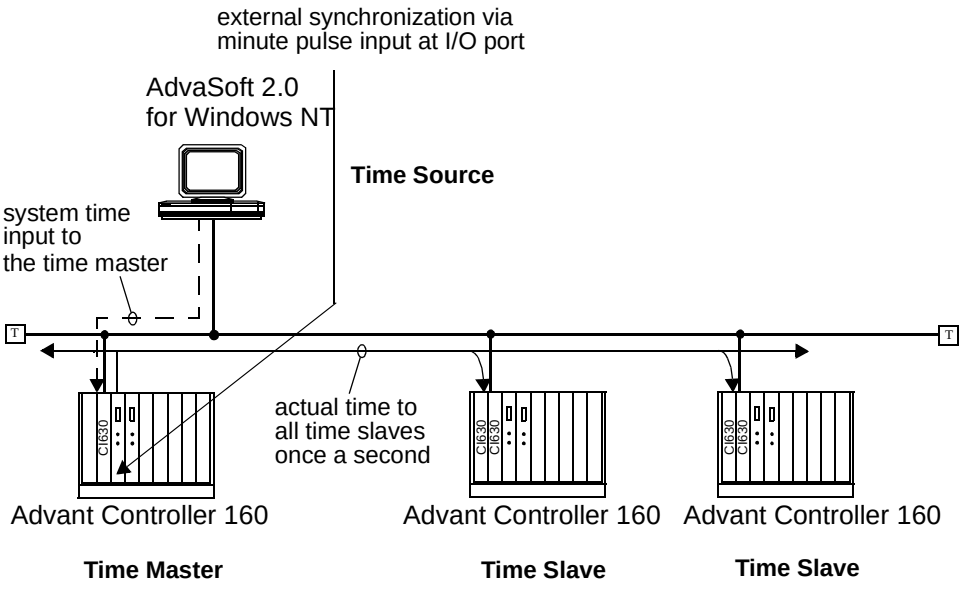

Figure 4-7. System Clock Synchronization within an Autonomous Control System using AC 160 and AdvaSoft 2.0 for Windows NT

Control System with Superordinate Advant Controller 450

The configuration is shown in Figure 4-8.

The controller Advant Controller 450 is time master. It can be synchronized via MB300 or via an external minute pulse. The other controllers at the Advant Fieldbus 100 are time slaves.

Advant Controller 450 cyclically sends time and date once per second as broadcast message via Advant Fieldbus 100.

The other controllers receive these messages and set its internal clocks.

Between two consecutive minute pulses the time master's internal clock runs independently ever providing the actual time.

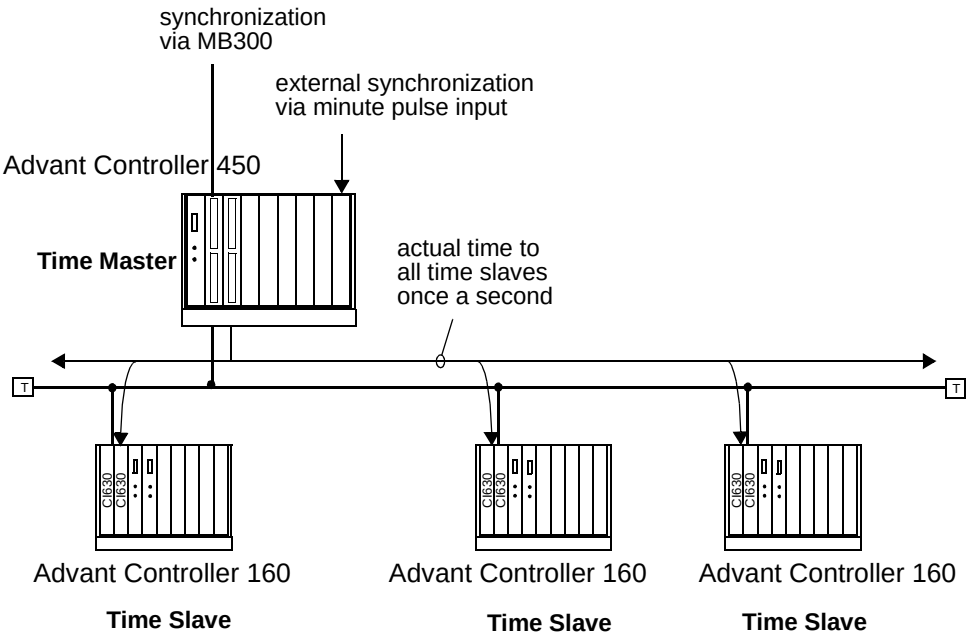

Figure 4-8. System Clock Synchronization within a Control System using AC 160 with Superordinate AC 450 and AS 500OS

Synchronizing Multi Processor Systems with Minute Pulse

The configuration is shown in Figure 4-9. All Processor Modules receive the same minute pulses from an external clock. Pin 4 (external time sync) and Pin 6 (GND) of the **I/O port** are used.

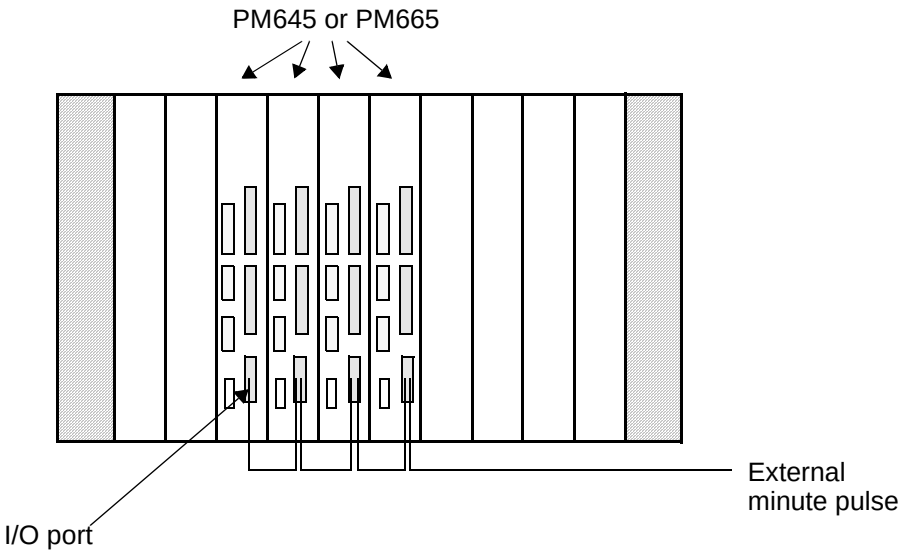

Figure 4-9. Time Synchronization of Several Processor Modules

Connecting a DCF77 Clock to Com B

All Processor Module are capable to connect to a DCF77 clock via serial port **Com B**. The connection depends on the type of DCF77 clock being used. The following example shows the pinout for the “Hopf 7001 DCF” clock:

Table 4-8. Connection Hopf 7001 DCF to Com B

Signal from Hopf 7001 DCF	Processor Module Com B
Pin 2 – TxD	Pin 3 – RxD
Pin 7 – GND	Pin 5 – GND

Chapter 5 Mechanical Design

Mechanically, Advant Controller 160 consists of subracks, cable ducts, modules and process connectors.

The mechanical design of the S600 and S800 I/O modules is described in detail in two separate Product Guides.

The subracks and cable duct are designed for wall mounting.

The 10-position controller subrack, RF616, is the primary subrack. It provides dedicated positions for Processor Module, Communication Interface and Bus Extender modules. There is a two-digit thumb wheel switch for setting the station address. The individual module address is given by its position in the subrack.

The bus connector links the controller subrack to an optional extension subrack via a bus cable (TK612). The 10-position extension subrack, RF620, extends the number of I/O modules of a station. The individual module address is given by its position in the subrack.

The cable duct, RC610, holds the process cables. It also provides ten screw terminals for connecting the cable shields of process cables to ground.

Figure 5-1 shows the physical layout and Figure 5-2 the dimensions of a fully equipped subrack with cable duct.

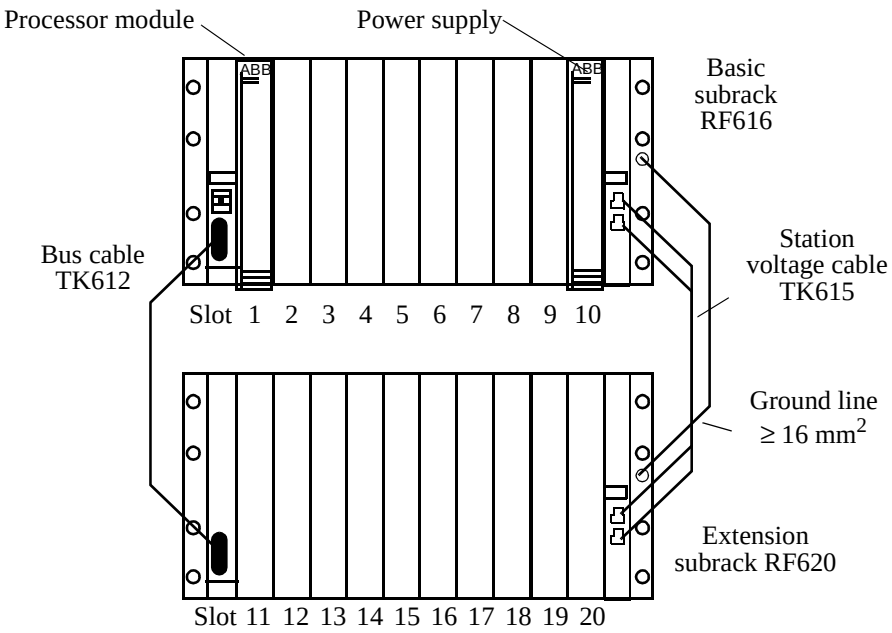

Figure 5-1. Physical Layout of Subrack

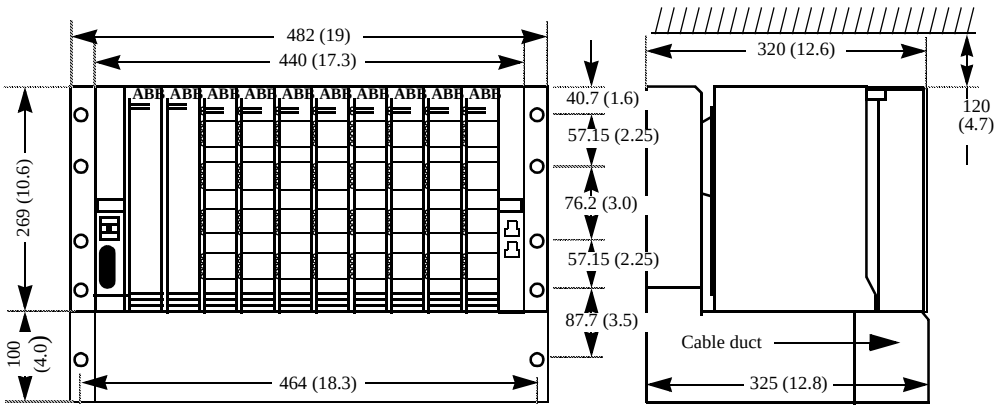

Figure 5-2. Dimensions of Subrack and Cable Duct

Advant Controller 160 can be delivered as separate subracks for mounting in any suitable cabinet, but it can also be delivered in standard RM5xx cabinets, please refer to Chapter 8.

Full information for mounting Advant Controller 160 in cabinets is given in the cabinets chapter of the *Product Guide for Advant OCS with Master Software, Overview,* or for details in the *Advant Controller 160 User's Guide*.

Chapter 6 Technical Data and Performance

6.1 General Data

The following configuration rules apply to an Advant Controller 160:

Table 6-1. Maximum Configuration of Advant Controller 160

Item	Max. no.
I/O signals	1,500 [1]
S600 I/O modules	75 [1]
Basic Units	1
Subrack per Basic Unit	2
S600 I/O stations	7
Subracks per I/O station	2
S800 I/O stations connected to Advant Fieldbus 100	32
S800 I/O modules per I/O station	24
Advant Fieldbus 100 Communication Interface modules	1–8 [2,3]
S800 I/O clusters	2[4]
Processor Modules	6 [5]
Submodule carrier module (SC610)	1 [6,7]

1 These limits are practical ones.
2 At least one Communication Interface (CI626, CI627, CI630, CI631) is required for any Advant Controller 160 configuration. For redundant Processor Modules 2× CI630/CI631 are recommended.
3 For non redundant communication with Advant Fieldbus 100, max. 4 modules of type CI626/CI627 can be used instead of CI630/CI631. In redundant configurations 4 pairs of CI630/CI631 must be used.
4 All I/O modules have to be configured without gap, so 24 modules occupy a maximum of 2 cluster.
5 Must be put into the controller basic subrack (position 3–8)
6 SC610 can hold up to 2 MVI modules.
7 Not supported by dual redundant Processor Modules (CPU redundancy), requires one PM640 or PM644 or PM645B or one PM665 in station redundancy.

6.2 Communication

Data Set elements hold references to DAT elements. Up to eight DAT elements can be connected to one Data Set.

A DAT element can hold one variable representing:

- 32 Booleans (32 bits) or 1 real number (32 bits) or
- 1 long integer number (32 bits) or 1 short integer number (16 bits).

The Data Set communication service cyclically transfers information from the DAT elements specified in the sending controller to the DAT elements specified in the receiving controller. The cycle time for each Data Set can be selected from the range 2 ms to 4 s.

The Data Set communication service is based on the broadcast principle, allowing any station to receive any Data Set sent on the bus. The advantage of broadcasting is that information only needs to be transmitted once regardless of the number of receiving stations. This principle is highly efficient when the same information is required in two or more stations, especially in time-critical applications.

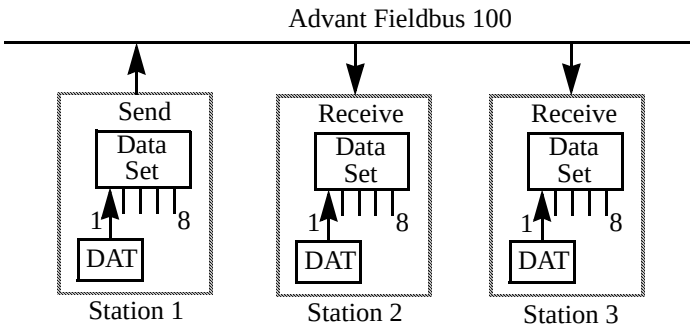

Figure 6-1. Data Set Communication

The Data Set communication uses resources on Advant Fieldbus 100, in the Communication Interface modules and also in the Processor Module. The system data shown in Table 6-2 and Table 6-3 are valid both for the main control Advant Fieldbus 100 and the second (subordinate) control Advant Fieldbus 100.

Table 6-2. Data Set Communication for Advant Controller 160

Description	Maximum No.
Maximum number of Data Sets (send and receive) per Processor Module	250
Maximum number of Data Sets (send and receive) per controller	400
DAT elements per Data Set	1 to 8
Selectable cycle times	2 to 4096 ms

Advant Fieldbus 100 runs at 1.5 Mbits/s. The transfer time for one Data Set is shown in the following table.

Table 6-3. Data Set Transfer Times for Advant Fieldbus 100

Data Set Size (= DAT Element per Data Set)	Transfer Time T_{tr}
1	0.088 ms
2	0.108 ms
4	0.156 ms
8	0.252 ms

To estimate the bus load for a given application, the following formula should be used.

Bus load in percent = $((N \times T_{tr}) / T_c) \times 100\%$, where:

N = the number of Data Sets (of the same size and T_c)

T_{tr} = the transfer time in ms (from the above table)

T_c = desired cycle time in ms (2, 4, 8, 16, …, 4096)

The resulting load must not exceed 75%, the remaining capacity must be reserved for background communication (e.g., remote programming).

Note that only the sending Data Sets are to be included in the calculation.

6.2.1 RCOM/RCOM+ Communication

An MVI channel may act as master or slave. In case of master operation it can have up to 25 slaves. Data between master and slave station is transferred using MVB elements (MVI data block) which is similar to Data Set elements. MVB elements hold references to DAT elements. 1 to 8 DAT elements can be connected to one MVB with RCOM. RCOM supports 1 to 8 DAT and RCOM+ supports 1 to 24 DAT's.

Table 6-4. Data Communication on RCOM/RCOM+

Description	Maximum No.
Number of nodes per MVI channel	25 [1]
Number of RCOM/RCOM+ networks per Advant Controller 160 master	4
Number of slaves per Advant Controller 160	50 [1]
Number of MVB's per Advant Controller 160	500
Number of MVB's per MVI channel	340

1 The maximum number of event generating slaves in an AC 110/AC 160 network is limited to 16.

The number of MVI data blocks that can be exchanged via the serial interface depends on the transmission speed and the specified cycle time. For performance estimation—including resulting CPU load—the figures for Advant Controller 110 within *Advant OCS Product Guide* as worst case figures can be used.

6.2.2 PROFIBUS-DP Communication

The PM644 is installed in the basic station of Advant Controller 160. It is equipped with one PROFIBUS-DP master interface which allows to use PROFIBUS I/O devices as distributed I/O. The setup of this link is defined by a number of database elements. The PROFIBUS link forms a local control network within the Advant system with the network numbers 1 to 9. Each I/O device may have a number from 0 to 125.

Table 6-5. Data Communication on PROFIBUS-DP

Description	Maximum No.
Number of buses per PM644	1
Number of slaves per bus	125
Number of nodes [1] per segment	32

1 A node is a PROFIBUS slave, the repeater or master.

The maximum distances that can be covered with PROFIBUS-DP depend on the used transmission speed:

Table 6-6. Distance Based on Transmission Speed on PROFIBUS-DP

Transmission Speed (Kbit/sec)	Distance / Segment
9.6	1,200 m
19.2	1,200 m
93.75	1,200 m
187.5	1,000 m
500	400 m
1,500	200 m
12,000	100 m

6.3 Event Transfer and Detection

Events can be detected with Digital Input modules DI650, DI651, DI652, DI685, DI885 or as calculated DI events. After the detection of an event in Advant Controller 160 the event can be transferred via RCOM/RCOM+ or Advant Fieldbus 100 to a Advant Controller 400 Series or to SattGraph 5000/AdvaSoft 2.0 for Windows NT Operator Station with OPC Server for further treatment. For each event queue (database element EVS(T) or EVS(S) in Advant Controller

160), up to 10 nodes on the Advant Fieldbus 100 network can be assigned to receive this event message.
The relative time errors between events detected in different Advant Controllers 160 within the same Advant Fieldbus 100 is < 10 ms. Relative time error within one controller is ≤ 1 ms. For more information about event transfer and detection, please refer to Table 6-7.

Table 6-7. Event Transfer and Detection

Description	Maximum No.
Event queues per Processor Module	32
Event entries per event queue	1,024
Event set elements per Processor Module	32
Event detection elements per event set element	32
Total number of event detection elements per Processor Module	1,024

Table 6-8. Event Transfer and Detection Resolution

Description	Minimum
Accuracy of calculated events DIC, AIC	10 ms [1]
Resolution of events from digital inputs (DI650, DI651, DI652, DI685, DI885).	1 ms

1 accuracy depends on selected scan time, with time stamp resolution 1 ms. Recommended scan time is 640 ms.

6.4 Interface for a Local Operator Station

Advant Controller 160 Processor Modules include an asynchronous serial interface (Com B), which is intended only for communication with a PC-based Human Machine Interface (HMI) package (3rd party product). In Advant Controller 160 data is exchanged, with e.g. the HMI package, by means of PARDAT elements. The supported communication protocol on this serial interface is the MODBUS I protocol. The serial interface on the CPU can only be used as a slave on MODBUS.

The number of MODBUS I commands that can be exchanged via the serial interface is depending on the type of command and also on the load of the CPU. For performance estimation the figures for Advant Controller 110 within Advant OCS Product Guide as worst case figures can be used.

6.5 Cycle and Scan Times

An Advant Controller 160 application program consists of one AMPL program (PCPGM) which can be further divided into a maximum of 31 (PM665: 63) execution modules (CONTRM, MASTER) or sequence modules (SEQ). Note that SEQ and STEP cannot be used with

redundant processing. Instead GRC and P_STEP can be used. Different cycle-times may be assigned to the execution modules so that the AMPL program can include both fast and slow control functions. Cycle times can be chosen from the range 2 ms to 20 s in steps of 2 ms. For applications with redundant Processor Modules cycle times smaller than 10 ms are not applicable.

For triple redundant configuration maximum cycle time is 1 second.

Control tasks with shorter cycle times always have a higher priority than those with longer cycle times. The execution order of modules with equal cycle times can be selected explicitly. Activation once at start can be chosen by the CONTRM's call parameter C2.

6.6 I/O Scanning

The scanning of I/O modules is directly related to the cycle time of the execution module.

Each execution module reads its inputs before execution of its AMPL elements. This guarantees a consistent image of the process signals. After execution of the AMPL elements, the module writes the calculated results to the outputs.

6.7 CPU Load Calculation

To determine the CPU load for an Advant Controller 160, the maximum load values available for the application program as shown in Table 6-9 must be considered.

Table 6-9. Maximum Usable CPU Load for Application Program

CPU configuration	Maximum load per CPU [%]	Maximum load per controller with single CPUs [%]	Maximum load per controller with redundant CPU pairs [%]
2 single CPU's or 1 redundant pair	70	2×70	70
4 single CPU's or 2 redundant pairs	70	4×60	2×60
6 single CPU's or 3 redundant pairs	70	6×50	3×50

6.8 CPU Load Calculation, Data Set Communication

The OCS Product Guides provides load data from Data Set communication for Advant Controller 110. These data can be used for PM640, PM644, PM645, and PM646 if divided by 3. For PM665 this has not been measured yet.

6.9 Memory Requirements

1 Mbyte of memory is available for the application program. For a rough calculation of the application memory requirements, the following table can be used.

Table 6-10. Memory Requirements for 7 Different Application Programs

Program No.	Program description	Input/Output Data Set	Needed memory size (kByte)
1	1 CONTRM with 16 × 3 input AND.	48 inputs 16 outputs	3.25
2	1 CONTRM with 32 × 2 input AND.	64 inputs 32 outputs	3.75
3	1 CONTRM with 32 × 2 input AND + 1 CONTRM with 16 × 2 input AND.	96 inputs 48 outputs	6.0
4	5 CONTRM each with 32 × 2 input AND.	320 inputs 160 outputs	12.0
5	2 CONTRM each with 16 × 2 input AND + 15 CONTRM each with 32 × 2 input AND.	1024 inputs 512 outputs	37.5
6	As 3 plus 1 CONTRM with each 5 × 4 inputs and outputs via Advant Fieldbus 100.	96 inputs 48 outputs 10 Data Sets (each DS with 4 DAT's)	8.6
7	As 3 plus 1 CONTRM with each 50 × 4 inputs and outputs via Advant Fieldbus 100.	96 inputs 48 outputs 100 Data Sets (each DS with 4 DAT's)	19.1

Chapter 7 Environmental Immunities

7.1 Environmental Considerations

General

Advant Controller 160 is designed for a demanding industrial environment. Alternative cabinets is available for different degrees of protective rating (IP21, IP41, IP54). Interference from electrical sources is suppressed by a suitable solid design and particular installation rules. The building where the system is to be stored or installed should provide an environment such that established environmental conditions are not normally exceeded.

A hardened enclosure protects the printed circuit boards from mechanical and electrostatic damage and from electromagnetic interference. The equipment complies with the EC directives 89/336/EEC on electromagnetic compatibility, 73/23/EEC and 93/68/EEC on low-voltage apparatus. Limit values are given to: Corrosive gases, Temperature, Vibration, Moisture, Electro-Magnetic Compatibility, etc.

For further information about the environmental immunity, please refer to the Environmental Immunities chapter in the *Advant OCS with Master Software, Overview* Product Guide.

Temperature

It is important to note the temperature within cabinets and in the surrounding environment and atmosphere. Lower temperatures mean increased system reliability and availability.

The lives of wet, electrolytic capacitors and most semiconductors are greatly reduced if the maximum permitted temperatures are exceeded.

To avoid overheating, when ambient temperatures are high, take into consideration the heat dissipated in the cabinet. This is particularly important with sealed cabinets (IP54) with considerable number of circuit boards and ambient temperatures at levels approaching 40°C. It might be necessary to mount heat exchangers on the cabinet to bring down the temperature to levels below limits given in the environmental data sheet.

The different hardware modules in the controller and the I/O system have different outputs of heat. Accurate calculation of the heat produced by the system requires knowledge of the modules and the work cycle.

Maximum permitted temperature above the subracks in the cabinet is 55°C.

NOTE

There is normally no requirements for fans in an Advant Controller 160.

Chapter 8 Ordering

8.1 Price List Structure

Depending on the desired I/O configuration one or several price books and price lists must be used when ordering an Advant Controller 160 with local S600 I/O, distributed S800 I/O or additional hardware modules to support enhanced features, e.g., burner management, turbine control, or safety applications.

Advant Controller 160 Version 2.1 (3BSE020695/B)

Price Book AC 55/70/110/160, AdvaSoft and OPC Server (3BSE001780/L).

See this Product Guide.

S800 I/O Version 3.2 (3BSE014394/D)

Price Book S800 I/O (3BSE020696/A).

See S800 I/O Product Guide (3BSE015969R301).

Spare Parts (3BSE001783/K)

Price Book AC 55/70/110/160, AdvaSoft and OPC Server (3BSE001780/L).

See this Product Guide.

8.2 Assembled Delivery or Loose Part Delivery

The item **Assembly and test** in Table 8-1 determines if the controller shall be mounted in cabinets or not. If this item is not ordered the delivery will be a loose part delivery.

Note also that in Table 8-1 the items for CE-marking are different for an assembled delivery and for a loose part delivery.

8.3 Loose Part Delivery and CE-marking

If an Advant Controller 160 is ordered as a loose part delivery and the intention is to mount the equipment in other cabinets than RM500, certain considerations must be taken to make it follow the provisions of the EMC Directive 89/336/EEC, Low Voltage Directive 73/23/EEC, and 93/68/EEC.

- The cabinet or series of cabinets mounted side by side must be radio-proof.
- Protection against line conducted radio emissions is obtained by means of a mains net filter placed in the cabinet close to the incoming mains cable.
- Communication cable shields must have a capacitive grounding at the point where they enter the cabinet.

The conditional EC-Declaration of Conformity, which accompanies the loose part delivery, must be signed by the person responsible for assembling the controller in cabinets.

8.4 Reference Guide

This is the Reference Guide for Price List **3BSE020695/B**.

8.4.1 General and Normative Requirements

Table 8-1. General and Normative Requirements

Description	Consists of	Article No.
CE-marking, Cabinet Mounted Delivery	EC Declaration of Conformity Mains Filter.	3BSE009129R1
CE-marking, Loose Parts Delivery	Conditional EC Declaration of Conformity.	3BSE009130R1

8.4.2 Basic Unit

Table 8-2. Basic Units

Description	Consists of	Article No.
Advant Controller 160 2.1 Basic Unit, Consisting of: Subrack, cable duct, software license, CD-ROM including system software, AMPL Libraries, system software extensions, user documentation.	RF616, RC610, Software on CD-ROM.	3BSE005559R3

8.4.3 Hardware Options

Additional hardware modules and equipment to support enhanced features, e.g., burner management, turbine control, or safety applications, can be ordered directly via Price List *Advant Controller 160 Special Item*s (3BDS 100 580) of Regional Center Germany.t

Table 8-3. Hardware Options

Description	Consists of	Article No.
Dummy Module	RB601	3BSE002803R1
I/O Fan Unit 24 V	RC620	3BSE003097R1
CPU Communication Cable Set used to load the communication section (CS) software of a Processor Module.	W173	GKWF310703R1
PM640 Processor Module, for non redundant processing	PM640	3BSE010534R1
PM644 Processor Module, for non redundant processing, PROFIBUS-DP, rotational speed signal input.	PM644	3BSE014664R1
PM645B Processor Module[1], for redundant processing, high speed link, rotational speed signal input.	PM645B	3BSE010535R1
PM646 Processor Module, for redundant processing with additional monitoring functions for safety application systems.	PM646	3BSE014700R1
PM665 Processor Module, Power PC based. For redundant processing, high speed link, rotational speed signal input, and high performance requirements.	PM665	3BDS005799R1

1 PM645B replaces Processor Modules PM645A and PM645C that are no longer available.

8.4.4 Upgrade and Update

Available upgrades and updates of Advant Controller 160 Software. for an upgrade or update order you have to state the SEAPR order number of the original delivery. An upgrade or update cannot be ordered together with any other item in the price list.

Table 8-4. Upgrades and Updates of Advant Controller 160 Software

Description	Consists of	Article No.
Upgrade Advant Controller 160 Software to version 2.1. The upgrade license is valid for all Processor Modules in one Basic Rack RF616.	Software on CD-ROM.	3BDS005572R3
Update Advant Controller 160 Software to latest revision of version 2.1[1]	Software on CD-ROM.	3BDS005591R3

1 Updates can be ordered after release of a new revision and approved Status Report.

8.4.5 Communication

Table 8-5. Advant Fieldbus 100

Description	Consists of	Article No.
Advant Fieldbus 100 **terminator kit coaxial** (1 kit required per bus cable)	1 × 75 Ω BNC terminator plug 1 × ditto with ground lead	3BSE006244R1
Modem for Advant Fieldbus 100 conversion **coaxial/optical**	TC630	3BSE002253R1
CI626 Advant Fieldbus 100 interface kit to **single line (coaxial)**	1 Bus interface CI626, AF 100 connector kit for one bus line only	3BSE004006R1
CI627 Communication Interface **(twisted pair)**	1 Bus interface CI627, 2 connectors for AF 100	3BSE009799R1
CI630 Advant Fieldbus 100 interface kit to **single line (coaxial)**	1 Bus interface CI630, AF 100 connector kit for one bus line only	3BSE011001R1
CI630 Advant Fieldbus 100 interface kit to **redundant bus (coaxial)**	1 Bus interface CI630, AF 100 connector kit for both bus lines	3BSE011002R1
CI631 Communication Interface **(twisted pair)**	1 Bus interface CI631, 2 connectors for AF 100	3BSE016347R1
Modem for Advant Fieldbus 100 conversion **coaxial/twisted pair**	TC513V1	3BSE018405R1

Table 8-5. Advant Fieldbus 100 (Continued)

Description	Consists of	Article No.
Modem for Advant Fieldbus 100 conversion **twisted pair/optical**	TC514V2	3BSE013281R1
Modem for Advant Fieldbus 100 **repeater twisted pair/twisted pair**	TC515V2	3BSE013284R1
Advant Fieldbus 100 **terminator twisted pair** (1 required per bus cable)	TC501V150	3BSC550038R1
Advant Fieldbus 100 **Trunk Tap** for **twisted pair**	TC506	3BSC840074R1
Advant Fieldbus 100 **Connection Kit to optical**	AF100K01	3BSE005544R1
Advant Fieldbus 100 **Connection Kit to redundant bus coaxial** (two bus lines)	AF100K02	3BSE005545R1
Advant Fieldbus 100 **Connection Kit for single line**	AF100K03	3BSE006251R1

Table 8-6. Multi Vendor Interface

Description	Consists of	Article No.
Submodule Carrier, required for connection of CI532. Two CI532 fit into one carrier.	SC610	3BSE001552R1
MVI, Multi Vendor Interface with **RCOM/ RCOM+** protocol. It holds two buses.	CI532V01	3BSE003826R1
MVI, Multi Vendor Interface with **MODBUS I** protocol. It holds two buses.	CI532V02	3BSE003827R1
MVI, Multi Vendor Interface with **Siemens 3964(R)** protocol. It holds two buses.	CI532V03	3BSE003828R1
Short Distance Modem for cable length < 10 km. Power 24V d.c., width = 55 mm.	TC562	3BSC630049R1
Cable Assembly for connection of CI53x to modem TC562.	TK595	3BSE006830R1

Table 8-6. Multi Vendor Interface (Continued)

Description	Consists of	Article No.
SERCOS Interface.[1]	SC610, CI590, TC590V02	3BHS105393
Interbus S Interface.[1]	CI680, software on diskette	3BHF000357R1

1 Can be ordered directly at CHIND – BU Printing, Dept. IDR (phone: +41 56486 8859).

8.4.6 Power System

Table 8-7. Power Supply in Rack

Description	Consists of	Article No.
Power supply module Input: 110/120/220/240 V a.c. or 110/220/250 V d.c. Output: 24 V, 60 W, d.c. Fits sub-rack	SA610 Open-ended mains cable Connector for relay output	3BSE000655R1

Table 8-8. Power Supply in RM5xx (width 800 mm)

Description	Consists of	Article No.
Power supply Kit Input: 120 V a.c. Output: 24 V, 10 A, d.c.	SA161 Including power switch, mounting plate and cables	3BSE005746R1
Power supply Kit Input: 230 V a.c. Output: 24 V, 10 A, d.c.	SA162 Including power switch and cables	3BSE005747R1
Power supply Kit Input: 110/120/220/240 V a.c. or 110/220/250 V d.c. Output: 24 V, 60 W, d.c.	SA610 Including power switch, mounting plate and cables	3BSE005748R1

Table 8-9. Power Supply in RM5xx (width 700 mm)

Description	Consists of	Article No.
Power supply Kit Input: 120 V a.c. Output: 24 V, 10 A, d.c.	SA161 Including power switch, mounting plate and cables	3BSE007040R1
Power supply Kit Input: 230 V a.c. Output: 24 V, 10 A, d.c.	SA162 Including power switch and cables	3BSE007041R1
Power supply Kit Input: 110/120/220/240 V a.c. or 110/220/250 V d.c. Output: 24 V, 60 W, d.c.	SA610 Including power switch, mounting plate and cables	3BSE007042R1

Table 8-10. Power Supply for Field Equipment

Description	Consists of	Article No.
Single a.c Power Supply Input: 120 V a.c., 50/60 Hz Output: 24 V, 10 A, d.c., unregulated	SA161 SX554 TK402V027	3BSE003591R1
Single a.c Power Supply Input: 230 V a.c., 50/60 Hz Output: 24 V, 10 A, d.c., unregulated	SA162 SX554 TK402V027	3BSE003592R1
Single a.c Power Supply Input: 120 V a.c., 50/60 Hz Output: 48 V, 5 A, d.c., unregulated	SA171 SX554 TK402V027	3BSE003593R1
Single a.c Power Supply Input: 230 V a.c., 50/60 Hz Output: 48 V, 5 A, d.c., unregulated	SA172 SX554 TK402V027	3BSE003594R1

Table 8-11. Main Supply Filter

Description	Consists of	Article No.
Main Supply Filter, 250 V, 20 A	–	3BSC740007R1

Table 8-11. Main Supply Filter (Continued)

Description	Consists of	Article No.
Main Supply Filter, 250 V, 55 A	–	3BSC740008R1
Main Supply Filter, 250 V, 80 A For DC main supply, 24 V d.c., 48 V d.c.	–	3BSC740009R1

8.4.7 S600 I/O

Table 8-12. S600 I/O Units

Description	Consists of	Article No.
I/O station, non redundant bus extender	Subrack RF615, Cable duct RC610 Bus extender CI610	3BSE000650R1
I/O extension kit	Subrack RF620, Cable duct RC610 Bus cable TK612, Power cable TK615	3BSE011071R1
I/O bus extension kit	Bus extender CI615 for base station Bus terminator TC610 for I/O extension bus	3BSE000756R1
I/O station, **redundant** bus extender	Subrack RF615, Cable duct RC610 2 Bus extenders CI610	3BSE011004R1

Table 8-13. S600 Analog Input Modules

Description	Consists of	Article No.
32 channels, 12 bits resolution, single ended, 0-20 mA, shunt 250 Ω	AI610	3BHT300000R1
16 channels, 12 bits resolution, differential, 0-20 mA, 4-20 mA, ±20 mA or ±10 V, shunt 250 Ω, CMV 100 V, CMRR > 80 dB (16 2/3, 50 or 60 Hz)	AI620	3BHT300005R1
16 channels, 12 bits resolution, galvanic isolated as one group, 0-20 mA, CMV 50 V, CMRR> 100 dB, Shunt 100 Ω	AI625	3BHT300036R1

Table 8-13. S600 Analog Input Modules (Continued)

Description	Consists of	Article No.
12 channels for Pt100 or resistance, 3- or 4-wire (2 wire with extra wiring om process connector), 13 bits resolution, -200 to +600°C or 0-500 Ω, 0.5 V, CMRR > 100 dB, opto-isolated as one group	AI630	3BHT300011R1
14 channels for thermocouple or millivolts and 2 channels for ambient (CJ) temperature measurement with Pt100, 12 bits resolution, CMRR > 120 dB, opto-isolated as one group	AI635	3BHT300032R1

Table 8-14. S600 Analog Output Modules

Description	Consists of	Article No.
16 channels, 12 bits resolution, 0-20 mA, 0-10 V, opto-isolated as one group	AO610	3BHT300008R1
8 channels, 12 bits resolution, 0-20 mA, 4-20 mA ±20 mA, 0-5 V, 0-10 V, 1-5 V, ±10 V, each channel opto-isolated	AO650	3BHT300051R1

Table 8-15. S600 Analog Input/Output Modules

Description	Consists of	Article No.
AX645, 16 analog input channels, 4-20 mA, each configurable as input or output, 14 Bits resolution for input, 16 Bits resolution for output, opto-isolated as one group	AX645	3BHB001914R1

Table 8-16. S600 Pulse Counting Module

Description	Consists of	Article No.
5 counter channels, each with two counter inputs, max 100 kHz and one Strobe and one Set input, ±13 mA, 24 V d.c. or 5 V d.c. (only 24 V for Set), each input individually opto-isolated, connection via 15 Pin Sub-D for each channel. Operation modes: 1. Up- & down- counting 2. Frequency & difference measurement 3. Difference measurement 4. Position & rotational speed measurement	DP620	3BHT300016R1
Cable Kit for DP620. Connection unit TX620 and cable assemblies TK620V030.	TX620K01	3BSE009963R1
Speed meter input, max 50 kHz, ±13 mA, 24 V d.c. or 5 V d.c., detection of direction through second speed meter input, over-speeed trip logic with trip signal output via solid state 24 V d.c. and dry contact 60 V d.c., speed meter inputs and solid state output are individually opto-isolated.	DP640	3BHT300057R1

Table 8-17. S600 Digital Input Modules

Description	Consists of	Article No.
32 channels, 24 V d.c., non-isolated	DI610	3BHT300004R1
32 channels, 24 V d.c., opto-isolated in four groups	DI620	3BHT300002R1
32 channels, 48 V d.c., opto-isolated in four groups	DI621	3BHT300012R1
32 channels, 60 V d.c., opto-isolated in four groups	DI622	3BHT300013R1
16 channels, 120 V a.c., opto-isolated in four groups	DI635	3BHT300015R1
16 channels, 230 V a.c., opto-isolated in four groups	DI636	3BHT300014R1

Table 8-17. S600 Digital Input Modules (Continued)

Description	Consists of	Article No.
32 channels, 24 V d.c., opto-isolated in four groups, sequence of event or pulse catching capability	DI650	3BHT300025R1
32 channels, 48 V d.c., opto-isolated in four groups, sequence of event or pulse catching capability	DI651	3BHT300026R1
32 channels, 60 V d.c., opto-isolated in four groups, sequence of event or pulse catching capability	DI652	3BHT300027R1
32 channels, 24/48 V d.c., internal 48 V sensor power supply**,** opto-isolated, sequence of event capability, wire break supervision	DI685	3BSE011613R1

Table 8-18. S600 Digital Output Modules

Description	Consists of	Article No.
32 channels, 24 V d.c., short-circuit proof transistors, max. 200 mA, non-isolated	DO610	3BHT300006R1
32 channels, < 60 V d.c., short-circuit proof transistors, max. 0.5 A, opto-isolated in four groups	DO620	3BHT300009R1
16 channels, 24 V d.c., short-circuit proof transistors, max. 2.4 A, isolated in eight groups	DO625	3BHT300040R1
16 channels, 24-250 V a.c./d.c., relay contacts [1, 2]	DO630	3BHT300007R1
6 channels, **< 60 V d.c**., relay contacts each output separately isolated.	DX610	3BSE013087R1

1 Relay data Load current: max 2 A min 20 mA Breaking Capacity: a.c. max 500 VA d.c. max 40 W
2 Relay data Load current: max 2 A, Breaking Capacity: max 120 W for d.c. loads

8.4.8 Cables and Connectors

Table 8-19. Cables and Connectors

Description	Consists of	Article No.
Front connector with screw terminals	TF620	3BHT100013R1
Process cable w. fitted connector TF610, unscreened, l = 3 m (9.8 ft.)	TK630V030	3BSC950007R1
Process cable w. fitted connector TF610, unscreened, l = 5 m (16 ft.)	TK630V050	3BSC950007R2
Process cable w. fitted connector TF610, unscreened, l = 10 m (32.8 ft.)	TK630V110	3BSC950007R3
Process cable w. fitted connector TF610, screened, l = 3 m (9.8 ft.)	TK640V030	3BSC950008R1
Process cable w. fitted connector TF610, screened, l = 5 m (16 ft.)	TK640V050	3BSC950008R2
Process cable w. fitted connector TF610, screened, l = 10 m (32.8 ft.)	TK640V110	3BSC950008R3
Terminal unit TX650 one per I/O module is required	AC110K11	3BSC840005R1
Mounting bar for terminal unit RA620	AC110K09	2166 0559-F
Cable from base to I/O station, 2.5 m (8 ft.)	TK610V025	3BHT200007R1
Cable from base to I/O station, 5 m (16 ft.)	TK610V050	3BHT200008R1
Cable from base to I/O station, 10 m (32 ft.)	TK610V110	3BHT200009R1

Table 8-20. Cable Set for Redundant and Parallel Processing

Description	Consists of	Article No.
CPU connection cable set for data exchange (parallel processing), l = 30 cm	TK661V003	3BSE010995R1
CPU connection cable set for data exchange (parallel processing), l = 50 cm	TK661V005	3BSE010995R2
CPU connection cable set for data exchange (parallel processing), l = 6 m	TK661V060	3BSE010995R3
CPU connection cable set for data exchange (parallel processing), l = 8 m	TK661V080	3BSE010995R4

Table 8-20. Cable Set for Redundant and Parallel Processing (Continued)

Description	Consists of	Article No.
CPU connection cable set for redundancy, l = 30 cm	TK662V003	3BSE010996R1
CPU connection cable set for redundancy, l = 6 m	TK662V060	3BSE010996R2
CPU connection cable set for redundancy, l = 8 m	TK662V080	3BSE010996R3

8.4.9 Assemby and Test

Table 8-21. Assembly and Test

Description	Consists of	Article No.
Assembly and Test of subrack in RM500 cabinet. Applicable if assembled by ABB Automation Products in Västerås.	–	3BSE016033R1

8.4.10 Packaging Options

Table 8-22. RM500V1 Cabinets (width 800 mm)

Description	Consists of	Article No.
Cabinet RM521 ventilated cabinet IP21, height = 2125 mm	RM521	3BSE016063R1
Cabinet RM522 ventilated cabinet IP41, height = 2125 mm	RM522	3BSE016064R1
Cabinet RM523 sealed cabinet IP54, height = 2125 mm	RM523	3BSE016065R1
Plate holder for one RM500V1 cabinets (2125 mm)	Plate holder	3BSE016259R1
End panel for RM500V1 cabinets (2125 mm)	End panel	3BSE016253R1
Replacement of single door to double door. For RM500V1 cabinets (2125 mm).	Door	3BSE016260R1
Shield plate, to be used between cabinets in a row (2125 mm)	Shield plate	3BSE016256R1
Locking Device Cylinder, RM500.	Lock	3BSE016258R1

Table 8-23. RM500V2 Cabinets (width 700 mm)

Description	Consists of	Article No.
Cabinet RM507 ventilated cabinet IP21, (H= 2225 mm)	RM507	3BSE016051R1
End panel for RM5xx cabinets (H=2225 mm)	End panel	3BSE016254R1
Shield plate, (H=2225 mm)	Shield plate	3BSE016257R1

8.4.11 S800 I/O

S800 I/O modules need to be ordered from Price Book S800 I/O (3BSE020696/A), Price List S800 I/O Version 3.2 (3BSE014394/E). Note that Advant Controller 160 version 2.1 does not support all S800 modules that are mentioned in the Price List. The following table applies:

Table 8-24. S800 I/O modules for Advant Controller 160

Type	Supported Modules
Analog Input	AI801, AI810, AI820, AI830, AI835
Analog Output	AO801, AO810, AO820
Digital Input	DI801, DI810, DI811, DI814, DI820, DI821, DI885
Digital Output	DO801, DO810, DO814, DO815, DO820, DO821
Pulse Counter	–

8.4.12 Documentation

Table 8-25. Documentation on Advant Controller 160

Title	Description	Article No.
Advant OCS with Master SW User Documentation on CD-ROM	Complete Documentation of Advant OCS with Master software on CD-ROM.	3BSE008143R1101
WWW Access to Advant OCS Documentation	Subscription for one year, single user.	3BSE001228R0001
WWW Access to Advant OCS Documentation	Subscription for 5 years, single user.	3BSE001503R0001

Table 8-25. Documentation on Advant Controller 160 (Continued)

Title	Description	Article No.
AMPL Configuration Advant Controller 100 Series Reference Manual	Contains instructions about configuration and application programming, fault tracing, execution, memory and load calculation of Advant Controller 110 and 160.	3BSE009626R501
Advant Controller 160 User's Guide	User's Guide describing the AC 160 equipment and how to install and commission the system.	3BDS005555R201
Data Base Elements Advant Controller 160 Reference Manual	Reference Manual describing the DB Elements used in Advant Controller 160.	3BDS005556R301
PC Elements Advant Controller 160 Reference Manual	Reference Manual describing the PC Elements used with Advant Controller 160.	3BDS005557R201
S600 I/O Hardware Reference Manual/ Rev B	Reference Manual describing the I/O and interface modules used with Advant Controller 100 Series.	3BSE011123R0001 / Rev B
S600 I/O Hardware Advant Controller 160 Reference Manual	Reference Manual describing the I/O and interface modules used with Advant Controller 160.	3BDS005558R201
Advant Fieldbus 100 User's Guide	User's Guide for Advant Fieldbus 100, containing a technical description, technical data and instructions for installation, commissioning and fault tracing used.	3BSE000506R801
RCOM Advant Controller 100 Series User's Guide	Contains a technical description, instruction for installation, start-up, design and fault tracing of Remote COMmunication in Advant Controller 110 and 160.	3BSE003181R0001 Rev. A
Multi Vendor Interface - MODBUS Advant Controller 100 Series User's Guide	Contains a technical description, instruction for installation, start-up, design and fault tracing for MVI/MOD-BUS in Advant Controller 110 and 160.	3BSE006712R0001 Rev. A
Multi Vendor Interface - Siemens 3964(R) Advant Controller 100 Series User's Guide	Contains a technical description, instruction for installation, start-up, design and fault tracing for MVI/Sie-mens 3964(R) in Advant Controller 110 and 160.	3BSE006713R0001 Rev. A

Table 8-25. Documentation on Advant Controller 160 (Continued)

Title	Description	Article No.
PROFIBUS-DP Advant Controller 110/160 User's Guide	Information about PROFIBUS-DP for Advant Controller 110 and Advant Controller 160.	3BDS100313R301
MODBUS Panel Connections User's Guide	How to connect a panel to Advant controller 160 via MODBUS interface.	3BDS004129R401
Installation Rules User's Guide	A description on the installation rules for Advant OCS, to ensure correct function in environments where such disturbances are present.	3BSE009178R0001 Rev. A
Interference-free Electronics. Design and Applications	Interference-free electronics teaches how to design circuit boards, electronic devices and systems with high immunity to interference. The book also deals with process adaptation, communication and power supply with immunity to interference.	3BSE000877R1

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