Control^{IT}

I/O System S900
Communication Interface for PROFIBUS DP, CI920

Industrial^{IT}
enabled

Manual

ABB

Control^{IT}

I/O System S900
Communication Interface for PROFIBUS DP, CI920

Firmware versions 1.5.x

Manual

NOTICE

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CE MARKING

This product meets the requirements specified in EMC Directive 89/336/EEC and in Low Voltage Directive 73/23/EEC.

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HART	HART Foundation

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1. About this document

Symbols

This publication includes **Warnings**, **Cautions** and **Information** issues where appropriate to point out safety-related or other important information. It also includes **Tips** to point useful hints to the reader. The corresponding symbols should be interpreted as follows:

	Warnings indicate the presence of a hazard which could result in personal injury.
	Cautions indicate the presence of a hazard which could result in equipment or property damage.
	Information alerts the reader to pertinent facts and conditions.
	Special preconditions to ensure explosion protection.

Although **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 **Warning** and **Caution** notices.

Terminology

DTM	Device Type Manager	
FDT	Field Device Tool	
HART	Highway Addressable Remote Terminal	
GSD	Generic Slave Data	
DCS	Distributed Control System	
PLC	Programmable Logic Controller	
OCS	Open Control System	
CIPB	S900 Communication Interface	
CI920	S900 Communication Interface	

All components of the I/O System S900 are available as S – or N – types. Type S – modules can be mounted in hazardous area. The following information is valid for both, type N – and type S- components, the modules are referenced without S or N (e.g. CI920 stands for CI920S and CI920N).

Related Documentation

Documentation	Number
S900 Mounting and Installation	3BDD010422
Datasheet	3BDD010420
Manual Digital I/O +Modules DO910 and DX910	3BDD010423
Manual Frequency Input DP910	3BDD010424
Manual Analog Inputs with HART AI930, AI931 und AO930	3BDD010425
Manual Temperature Input AI950	3BDD010426
Manual DTM for S900 (FDT 1.2)	3BDD010428
Manual DTM for S900 (FDT 0.98)	
Application Guide S900 HART Protocol	
Parameterization in Mode 1, Parameter Overview	S900_Manual_GSD-Parameters_Mode1
Parameterization in Mode 2, Parameter Overview	S900_Manual_GSD-Parameters_Mode2
Manual CB220	3BDD010437
CI920 Release Note	S900_Release-Note_CI920_Vx-x-x

This manual describes operation and handling of communication interfaces with the firmware versions given on third page. Actual information and latest news for specific versions are publicized by the Release Note of CI920.

2. Introduction

System features

I/O System S900 is a remote I/O system for use in hazardous areas. It provides bus-compatible local inputs and outputs (protection IP20) for connection of digital and analog field instruments. Due to its degree of explosion protection it can be mounted in both hazardous areas (zone 1 and zone 2) and safe areas.

The system consists of a mounting termination unit accommodating the power supply units, the communication interfaces, and the I/O modules. The passive mounting termination unit ensures power distribution and data transfer, and also provides the connection platform. The power supply units reliably power the entire system. One power supply unit is sufficient for normal operation. A second (redundant) power supply unit can be added, to improve the system availability. The communication interface controls all data traffic between the I/O modules and the supervisory open control system (OCS) or the programmable logical controller (PLC). The communication interfaces CI920 can also be used in redundancy mode (line redundancy and CI920 redundancy)
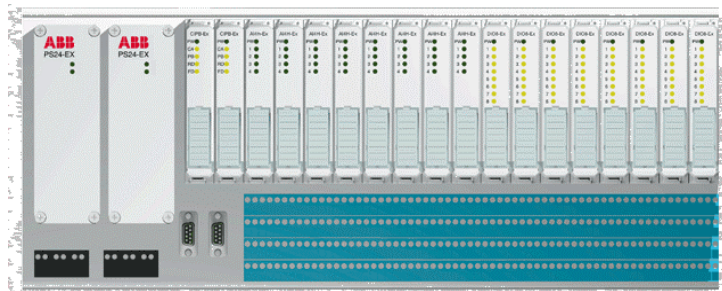

Figure 2-1 Remote I/O with a redundant power supply unit, a redundant communication interface, and 16 I/O modules (front view)

The mounting termination unit is accommodated in a suitable field housing (junction box) to protect it from environmental exposure. Field mounting in hazardous areas requires approved field housings with increased safety

(Eex-e) to ensure explosion protection. Appropriate ready-made S900 field housings are available for this purpose. The I/O System S900 is powered via special terminals with increased safety located on the mounting termination unit. The power supply units, the communication interfaces, and the I/O modules are plugged into the mounting termination unit and locked automatically. The power supply modules have a built-in shut-off mechanism with automatic locking and can be plugged/removed under power in zone 1, although the supply in the primary circuit which is not intrinsically safe is still active in this case. As a result, the I/O System S900 does not require an explosion-proof or pressurized housing and, therefore, is easy to handle.

The mounting termination unit and the power supply unit(s) ensure intrinsically safe power supply of the communication interfaces and up to 16 I/O modules. The mounting termination unit provides all internal connections. Thus, only the peripheral units need to be connected by the user. Also, hot swapping of the communication interfaces and I/O modules is possible, i.e. these units can be connected or removed during operation. This ensures easy replaceability of all active components, and a high degree of flexibility and user-friendliness.

Field instruments complying with protection class EEx ia IIC can be connected to the I/O modules. At present, up to 16 I/O modules can be run on the same mounting termination unit. Each I/O modules is designed for connecting 4 or 8 field instruments, depending on the respective model. The I/O modules and the underlying field instrument level are powered via the mounting termination unit. All intrinsically safe modules are self-feeding and short-circuit proof. No separate routing level with additional power supply and individual fusing is required.

HART communication in the field with all analog S900 I/O modules is possible via a PC or hand-held terminal. In addition, the special HART variants allow for a consistent HART communication up to the open control system (OCS). Cyclic transmission of all secondary HART variables, HART diagnostics, and (non-cyclic) configuration of all HART devices are possible.

The S900 I/O modules are slot-addressed and, therefore, do not require any settings on the modules themselves. The PROFIBUS address is either set via three coding switches, or is assigned via the system.

The S900 communication interface, the I/O modules, and the connected HART devices are configured and parameterized via a fieldbus network. No additional network is required for this. The communication interface and the

I/O modules have built-in LEDs allowing for "on site " diagnostics. All diagnostic and status indicator LEDs comply with DIN EN 60073 and NAMUR NE44. In addition to this, PROFIBUS diagnostics down to channel-specific error messages is possible via the communication bus.

Communication Interface CI920

Functionality

The communication interface connects the S900 Station to the external fieldbus. The data received via the fieldbus are distributed accordingly to the respective I/O modules. The parameters are submitted to a plausibility check. The incoming data are buffered and are available even in case of a fieldbus failure. When an I/O module needs to be replaced, the new module can be parameterized immediately.

The input data and diagnostic data from the I/O modules are collected and then put in the respective fieldbus data telegram.

Parameterization

The parameters are transmitted via the internal CAN bus. The transmission is triggered by events. When a parameter telegram is received via the fieldbus, the respective modules are parameterized immediately. When the communication interface recognizes a new module that has already been integrated in the project, this module is parameterized immediately.

Diagnostics

The transmission of diagnostic data from the I/O modules is triggered by events. A diagnostic message is transmitted immediately via the external fieldbus.

Input data

The input data are read cyclically from the communication interface. Digital modules transmit their data every 5 ms, whereas analog modules transmit

every 20 ms. These times are independent of the cycle time specified for the external fieldbus.

Output data

The transmission of output data is triggered by events. When an output data telegram is received via the fieldbus, all data are transmitted synchronously to the respective I/O modules.

I/O module monitoring

The connected I/O modules are monitored cyclically. When a module is not found, a diagnostic messages is generated. For the input modules, the defined default value is transmitted instead of the measured value. The default valid is marked as invalid.

Supported I/O Modules

Table 2-1 Supported I/O - modules

Type	Description	CI920 Version (Softw.)	
		Prm.-M. 1	Prm.-M. 2
Digital Input / Output			
DO910	Digital output, 4 x 1 channels (Solenoid driver)	> 1.0.x	> 1.2.x
DX910	Digital input / output, 1 x 8 channels	> 1.0.x	> 1.2.x
Analog Input / Output			
AI910	Analog input, 1 x 4 channels, active	> 1.2.x	> 1.2.x
AI930	Analog input, 1 x 4 channels, active, HART	> 1.0.x	> 1.2.x
AI931	Analog input, 1 x 4 channels, active, HART	> 1.2.x	> 1.2.x
AO910	Analog output, 1 x 4 channels	> 1.4.x	> 1.4.x
AO920	Analog output, 4 x 1 channels (isolated)	> 1.0.x	> 1.2.x
AO930	Analog output, 1 x 4 channels, HART	> 1.2.x	> 1.4.x.
Temperature			
AI950	Temperature input, 4 x 1 channels, resistor and thermocouple	> 1.2.x	> 1.4.x
Counter / Frequency			
DP910	Frequency input and counter, 2 blocks	> 1.4.x	> 1.4.x

3. System specifications

Required system components

The I/O System S900 in its smallest hardware configuration consists of the following components:

1 x TU921	Termination unit
1 x SA910	Power supply, 24VDC
1 x BP901	Power supply filter
1 x CI920	Communication interface
1 x DX910	Digital I/O module

If required, a 230 V AC / 24 V DC power supply unit must be provided by the customer to ensure 24 V DC power supply of the I/O System S900.

Requirements on PLC / OCS master systems

The I/O System S900 is designed for connection to all systems with a PROFIBUS DP master.

The PROFIBUS DP (V0) services provide the following functionality:

- Configuring/setting parameters of the S900 station upon re-start
- S900 diagnostic messages
- Reading HART secondary variables from connected field devices
- Reading HART diagnostics from connected field devices through PROFIBUS diagnostic messages.

To be able to use the full range of functions provided by the I/O System S900, the master should support additional functions. Modern, state of the art master systems support PROFIBUS DP V1 services and are capable of loading configuration data and parameter settings while the system is running and without affecting the slaves or requiring a network restart.

PROFIBUS DP V1 services allow you to:

- monitor the input and output data

- simulate (force) the S900 inputs/outputs
- configure the connected HART field devices

Selective loading of configuration data and parameter settings while the system is running allows you to

- modify specific parameters of the communication interface or of individual I/O modules
- add more S900 stations
- add, remove or replace S900 I/O modules.

All I/O modules whose parameter settings and configuration data are not changed continue cyclic communication. As long as the master is downloading data, all S900 outputs hold their states. Examples for modern master systems meeting the requirements stated above are:

- ABB AC800F
- ABB Symphony CMC60-2 / CMC70
- ABB AC800M

System Limits

Number of PROFIBUS stations

Up to 127 can be addressed within a PROFIBUS network. This number includes the PROFIBUS – master. Up to 32 stations can be connected to a PROFIBUS DP segment. When using repeaters, one can separate the network into several segments. Using the intrinsically safe PROFIBUS - DP, up to 10 stations can be connected to each segment.

The transmission rate and the permissible cable length specified for the segment must be observed. For example, a cable length of 400 m (1314ft) is permissible for a network with a transmission rate of 500 kbaud. Longer cables are possible when using fiber optic cables.

Number of I/O Modules

S900 can handle up to 16 I/O modules. They can be configured via the PROFIBUS, and their parameters can be defined individually for every

module or channel. The module slots can be assigned as required. However, the total amount of input data and output data is limited to 244 bytes, each. Note that the total amount of I/O data resulting from additional communication services (parameters, diagnostics, non-cyclic services) must not exceed 216 bytes for S900.

These limitations are specified in the GSD file (generic slave data file) available for S900. They are monitored by the configuring instance.

Table 3-1 Data of different I/O modules

I/O modules	I/O data and status [bytes]
DO910	1
DX910	3
AO910	8
AI910	8
AI950	8

If no cyclic HART secondary variables are to be transmitted, no system limitations result from this, since the max. possible amount of I/O data is always less than 216 bytes, with 8 bytes per module and a total of 16 modules. Thus, an I/O System S900 station can in any case handle up to 16 I/O modules.

However, the total number of transmittable HART variables is limited, due to the 216 bytes limit. With HART-compatible I/O modules (e.g. AI930) up to 8 HART variables can be transmitted with the cyclic data for each module. HART variables are 32-bit floating point numbers occupying 4 bytes.

Calculating example:

Table 3-2 Example of I/O byte calculation

Configuration	Input [bytes]	Output [bytes]
CI020	0	0
6 x AI930	6 x 8	0
4 x AO910	0	4 x 8
6 x DX910	6 x 2	6 x 1
Total	60	30

Total amount of I/O data [bytes]   = 60 + 30   = 90
Number of available bytes   = 216 –90   = 126
Number of possible HART variables   = 126 / 4   = 31

Cycle time

The PROFIBUS master defines the transmission rate to be used within the system. The internal cycle time is 5 ms for processing 128 binary signals and 20 ms for processing 64 analog signals. The response time of the entire system depends upon the total amount of I/O data of all PROFIBUS stations and of the processing capabilities of the higher-level control system.

The S900 output data are synchronized with the higher-level bus. Therefore, the internal cycle time has to be considered only once.

The following approximation formula is valid: $T_R = T_i + 2 \times T_B + T_{OCS}$, with

T_R = response time
T_i = internal cycle time
T_B = fieldbus cycle time
T_{OCS} = OCS cycle time

With a bus cycle time of 5 ms and an OCS cycle time of 5ms, the response time for 128 binary signals is $T_R = 5 + 2 \times 5 + 5 = 20ms$

The following illustration gives you an overview of the expected PROFIBUS cycle time, depending on the transmission rate and number of slaves. The cycle time also depends on the total amount of I/O data. An output data amount of 20 bytes and an input data amount of 80 bytes were assumed in the following example, corresponding to an S900 station with the following configuration:

- 32 digital outputs
- 48 digital inputs with state
- 16 analog inputs
- 8 analog outputs
- 8 secondary HART variables
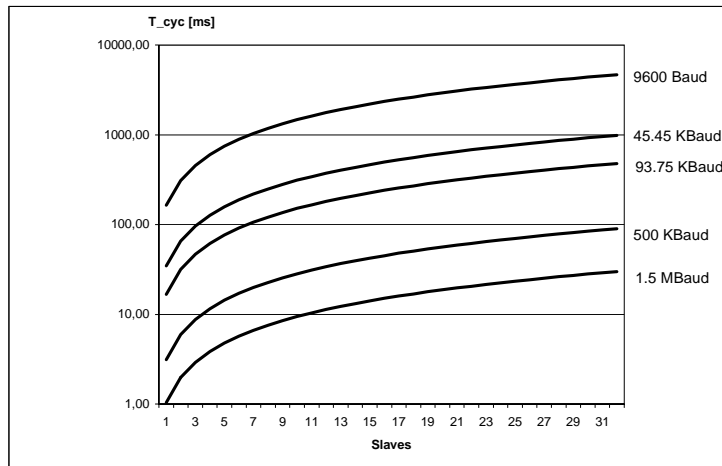
Figure 3-1 PROFIBUS DP cycle time

4. Communication via PROFIBUS DP V1

Slave address

Conventions

Up to 127 stations can be addressed via the PROFIBUS. However, only 32 stations may be run on each line without using a repeater. Since at least one master must exist on the bus, the maximum slave address range is 126. Note that diagnostic or configuration devices connected only temporarily to the bus (Class_2 masters) must be taken into account as well! Address 0 must not be used for slaves. Address 126 is reserved for commissioning slaves whose address can be configured via the PROFIBUS. When using two communication interfaces (redundancy), the permissible PROFIBUS address range is limited to 1...124., since the redundant CI920 receives a PROFIBUS address made up of the active CI920 address +n (with n being configurable).

Do not assign the same bus address to two stations. This will cause a crash of cyclic data transfer on both stations!

Setting the bus address

The setting is made via three coding switches on the termination unit.

The new address will only be active upon a CI920 restart. After changing an address always remove and plug in again the CI920, or switch off the station for a short time.
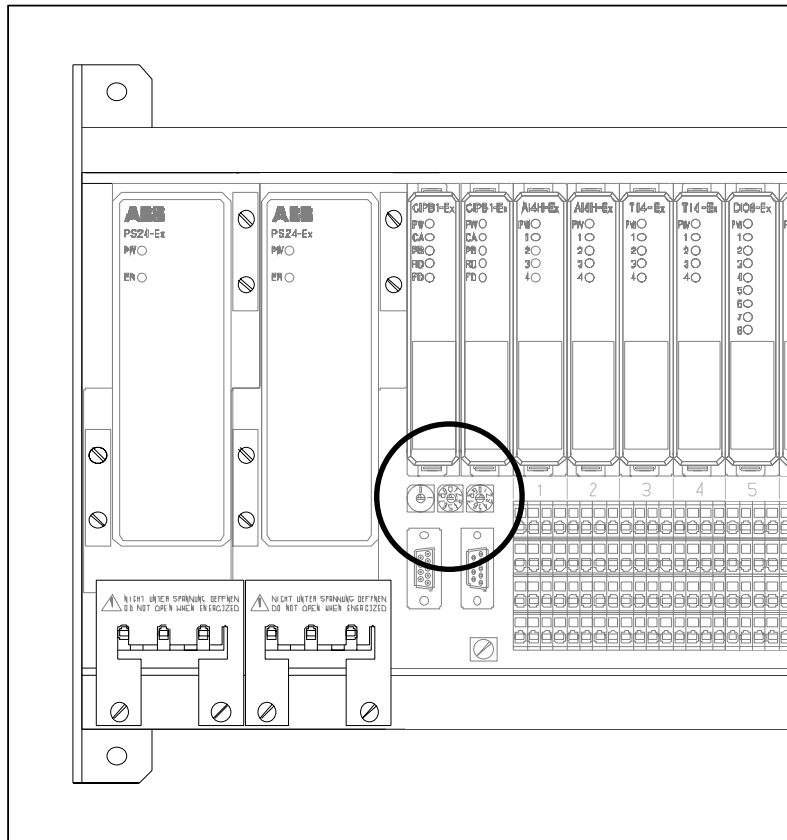
Figure 4-1 Termination unit, partial view

Every decimal place of the address is set individually using the respective coding switch:
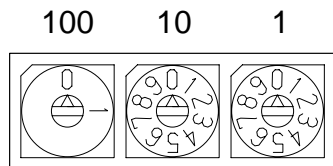
Figure 4-2 Coding switches

Factory setting

The factory setting of the S900 address is 0.

GSD (generic slave data) file

After physical connection of the stations to the PROFIBUS, the entire DP system must be configured in the PROFIBUS master. The vendors of industrial PLCs (Programmable Logical Controllers) or OCS (Open Control Systems) usable as PROFIBUS masters often provide user-friendly PC-based configuration tools for this purpose. The configuration is based on electronic data sheets, the so-called GSD (device data). In the GSD file all slave characteristics relevant for PROFIBUS operation are specified. A standardized data format is used to ensure vendor-independent slave configuration.

Structure of a GSD file

The general structure of the GSD file is specified in EN50170. More detailed information can be obtained from he PROFIBUS user organization (PNO, http://www.profibus.com/) The GSD files is usually provided by the vendor or is available in the Internet. The file extension identifies the language:

- Default: ?=d
- English: ?=e
- French: ?=f
- German: ?=g
- Italian: ?=i
- Portuguese: ?=p
- Spanish: ?=s

At present, the GSD file for S900 is available in English (ABB_04D2.GSD) and in German (ABB_04D2.GSG).

Every vendor of PROFIBUS slaves delivers a GSD file for the unit. This enables the user (or his configuration program) to eliminate possible errors resulting from wrong parameters as early as in the project planning phase.

The GSD file is an ASCII file and an be read with any text editor.

> **Note that the use of the original GSD file from the vendor is mandatory for proper functioning of the slave. Any modification of the GSD file may cause serious errors and is at the user's own risk.**

The GSD file contains communication-specific parameter like the supported transmission rate, and possible parameters of the slave. S900 is a so-called modular slave. Contrary to a compact slave, a modular slave has a variable structure, since it consists of several modules. The arrangement of the modules in the station is called the hardware configuration. The GSD file describes the individual modules and their characteristics. Among these are:

- Quantity of input data
- Quantity of output data
- Settable parameters
- Diagnostic information

Additionally, the system limitations are specified, e.g. the max. number of modules, the max. quantity of input and output data, etc.

Module description in the S900 GSD file

On PROFIBUS single modules of a modular slave as S900 are identified by the quantity of I/O data and its structure. Additionally in a GSD file the parameters can differ for modules with the same quantity of I/O bytes. There are some I/O modules with a variable quantity of I/O data (e.g. AI930 can deliver up to 8 secondary HART variables). For this reason the S900 GSD file can contain more than one variant for an I/O module. The selectable module is described as order number and variant in brackets. For example AI950 (TI4 R).

Compatibility

Within the I/O System S900 the downward compatibility is ensured: A CI920 with newer firmware runs with older I/O modules within a project. To use the full functionality of the I/O System S900 the following GSD - file versions should be used.

Table 4-1 Available GSD files for S900

CI920	GSD (Mode2) German ABB_04D2.GSG	English ABB_04D2.GSD	GSD (Mode1) German ABB_04D2.GSG	English ABB104D2.GSD
1.0.x	—	—		
1.1.x	—	—		
1.2.x			0.5.1	0.5.1
1.3.x	1.2.0	1.2.0	1.0.3	1.0.3
1.4.x	1.2.0	1.2.0	1.0.3	1.0.3

Mode 1 supports module wise parameterization
Mode 2 supports channel wise parameterization

Configuration

Definition
On PROFIBUS DP the configuration defines the structure of a modular slave and the cyclic data of its I/O modules.

To change the configuration of a PRFOFIBUS slave requires to leave the cyclic data exchange with its master. Additional mechanisms like HCIR (Hot Configuration In Run) can handle a bumpless re-configuration. S900 supports HCIR together with the ABB controllers AC800M and Symphony / Melody. Because the required parameters are described in the GSD – file of S900, HCIR is possible with every masters which allows the sending of parameter data without interrupting DataExchange state.

Variants

Table 4-2 Overview of S900 Communication interfaces

Order No.	Type*	Supported in mode	Description
CI920	CIPB	1, 2	Communication interface, PROFIBUS DP V1
CI920	CIPB C	2	Communication interface, PROFIBUS DPV1, with cyclic data
CI920	CIPB D	1	Communication interface, PROFIBUS DPV1, with hidden diagnostics feature
CI920	CIPB CD	1	Communication interface, PROFIBUS DPV1, with cyclic data and hidden diagnostics feature

CIPB

This variant has to be chosen generally. Both parameterization modes and redundancy are supported.

CIPB C

The Communication Interface itself sends cyclic datIa. This variant can be selected to enhance the diagnostics of the redundant PROFIBUS line (see chapter redundancy further details).

CIPB D

With this variant in parameterization mode 1 single channels can be deactivated to suppress diagnostic messages result from unused channlels.

CIPB CD

Combination from CIBP C and CIPB D available in mode 1.

Behavior

Cold start

The S900 interprets the Check_Cfg telegram sent by the master as the set configuration. If the telegram is free of error, it is acknowledged with a

positive response. Otherwise, a negative response is returned, together with the respective diagnostic message.

> **The S900 can start cyclic data exchange even if there is a mismatch between the set and the actual configuration.**

As a result, the project planning can be made on the basis of the planned final configuration, without requiring that the respective I/O modules are actually present. S900 will provide the configured default values for the missing modules.

Re-configuration in online mode

This term refers to an uninterrupted download of a set configuration (HCIR-Hot configuration in run mode). The HCIR configuration is mandatory for adding, removing or replacing I/O modules without affecting the actors of I/O modules that are not involved.

The S900 System accepts a new Check_Cfg telegram while it is running. When the system is re-configured, it leaves the DataExchange state for a short time (due to PROFIBUS requirements). During this time, the outputs maintain their last value until returning to the DataExchange state. If the online re-configuration procedure cannot be terminated properly, e.g. when the PROFIBUS communication is interrupted, the outputs are set to their default values. The S900 System is, thus, HCIR-compatible, without any limitations.

Note: The non-cyclic V1 services used in many PROFIBUS devices are only suitable for online re-parameterization. They cannot be used for modifying a slave's configuration (i.e. its I/O data setting).

Uninterrupted download from the S900 System is only possible if the master supports the HCIR configuration as well. However, many old master system versions require a reboot which, of course, does not allow for online re-configuration. Modern master systems like Symphony CMC60 or AC800F from ABB are not limited in this way and are best suited for online re-configuration.

If the application in the PLC or OCS is to be protected against unwanted signal failures or alarms during online re-configuration, their engineering

system must ensure that the inputs are maintained for a short time. HCIR-compatible OCRs support this function.

Refer to the PROFIBUS master user manual for details about using the HCIR.

Reaction in case of erroneous configuration telegrams

Modules not involved in the configuration changes continue operation, even if the S900 System partly cannot understand the configuration telegram. Implausible configuration and parameter telegrams may occur if there is a mismatch between the GDS (device data) file and the CIPB software version to be used.

Parameterization

Definition
On PROFIBUS DP the parameterization defines the behavior of a configured I/O module (line monitoring, range…)

Changes of parameterization does not affect the structure of I/O data, so a re – compilation of the project is not required any time. S900 accepts a parameter telegram without interrupting the cyclic data exchange. Modern DCS like ABBs AC800F are able to send parameter data interrupt free.

The following parameters have to be set for the communication interface:

Table 4-3 Communication Interface parameters

Parameter	Settings	Description
Parameterization mode	mode 1	Module-wise parameterization
	mode 2	Channel-wise parameterization
Grid frequency	50Hz / 60Hz	Mains frequency in the direct environment. See also description of analog input modules.
Analog data format	status MSB	Channel status is mapped on MSB of an Unsigned16 or Unsigned32 value.
	status LSB	Channel status is mapped on LSB (Bit 0) of an Unsigned16 or Unsigned32 value.
	no status	Channel status is not transferred
Rack size	4/8/16 modules	Set size of used termination unit. Communication interface only communicates with specified number of modules, beginning with slot 1 (left most).

Parameter	Settings	Description
Redundancy mode	off	In case of an error of the active CI920 or its PROFIBUS line the control takes over to the passive CI920, if plugged.
	mode 1	Two communication interfaces for line and redundancy.
	mode 2	Reserved
	mode 3	Reserved
Power supply	single	No supervision (diagnostics) of redundant power supplies.
	redundant	A power supply failure leads to a diagnostics.
Cyclic data*	function 1	Reserved
	function 2	Reserved
	function 3	Reserved
	special	Reserved
HCIR WCBC base	0..6300ms in steps of 100ms	**W**orst **C**ase **B**us **C**ycle. Timeout for monitoring the online re – configuration (HCIR). If the PROFIBUS – master supports HCIR, these parameters are set automatically.
HCIR WCBC factor	: 16 / : 1	The entered time constant WCBC base can be multiplied by 16.
HCIR active	on / off	This bit has to be set by the master before the following LeaveMaster – telegram starts the HCIR – sequence.
Address Offset value	0..124	Offset of the address of the redundant CI920.
Address Offset	On / off	Address Offset adjustment enable / disable
SF1		Reserved
SF2		Reserved
SF3		Reserved

*) only available / relevant for CI920 with own cyclic data (CIPB C and CIPB CD)

Behavior

Cold start

A parameter telegram sent by the master is submitted to a plausibility check in the S900. The system can only start up properly when the parameter telegram is free of errors. If there are any errors in the telegram, they are communicated to the operator via the diagnostic function.

Re-parameterization in online-mode

This term refers to the uninterrupted download of an updated parameter data set into a slave. While this procedure is in progress, the DataExchange state is never left. The I/O System S900 permits uninterrupted downloading if the

master is capable of sending new parameter telegrams. In some older master systems, however, the system needs to be rebooted in this case, leading to an interruption of the online-download. Modern master systems like Symphony CMC60 from ABB provide the required functionality and are, therefore, perfectly suited for online-parameterization.

Uninterrupted parameter download in accordance with the PROFIBUS specifications requires that the slave is NOT working in DPV1-mode, i.e. there is no non-cyclic communication with a Class_1 master. All systems acting as a Class_2 master to access DPV1 communication and capable of sending a new parameter telegram in online mode permit online-parameterization.

Please refer to the user documentation of the PROFIBUS master for details about how to perform online-parameterization.

Reaction in case of erroneous parameter telegrams

To comply with the PROFIBUS specification, the DataExchange state must be left when a negative parameter telegram acknowledgement occurs. Therefore, S900 always acknowledges the telegram with a positive response, even if individual module parameters were identified as erroneous. The errors are then communicated to the operator by a diagnostic message.

Modules that receive invalid new parameters retain their previous parameters.

This ensures continuous operation of all modules that are not directly affected by the error.

Cyclic data exchange

I/O data transmission

Measuring value status

A status bit can be assigned to every measuring value, identifying it as valid (status bit = 0) or invalid (status bit = 1). If a measuring value is "invalid", the

configured default value (or last valid value) is transmitted instead. An input value is invalid, if the I/O module cannot find a plausible measuring value, e.g. in case of a line break or short-circuit. All channels of a module are identified as invalid if the module is missing or an internal module error has occurred. Output signals have no status at all.

Digital values

Digital input data can be transmitted with or without a measuring value status (as configured). A set status bit identifies the respective channel as invalid. In this case, the last valid value or the configured default value is transmitted instead. A signal status bit and, if applicable, a measuring value bit is assigned to every channel.

Analog values

Analog values are transmitted as Unsigned16 values in the Motorola format, with 15-bit accuracy. The measuring value status can be transmitted in bit position 0 or 15. Data are transmitted on channel 1 and higher. When a channel is invalid, the status bit is set, and the last valid value or the configured default value is transmitted instead of the measured value.

HART variables

HART variables are transmitted as FloatingPoint values. If the measured value is invalid, NAN (Not A Number) is transmitted as the default value. HART variables are transmitted after the data of the analog channels. The following order is valid: from the lowest channel to the highest, from the lowest variable to the highest.

Non-cyclic services DPV1

Functional principle

Besides cyclic data exchange, the DPV1 extension also permits non-cyclic data exchange with a slave. Due to this fact, the I/O System S900 does not need a local service or configuration interface. The organization, i.e. the

information which data is to be read or written, is communicated through slots and indices. The standard allows for free assignment of the data to the slots and indices. However, the assignment Slot = Module is recommended for a modular slave like S900. Slot #0 corresponds to the communication interface. A maximum of 255 slots and indices (0...254) is possible. Non-cyclic services can be initiated by a Class_1 or Class_2 master. A Class_1 master is also cyclically exchanging data with the slave, whereas a Class_2 master is only run temporarily on the PROFIBUS. An example for a Class_2 master is a PC with a PROFIBUS card (laptop with a PCMCIA card). It can read input and output data from the slave as well as its configuration, parameters, and diagnostic data. However, it cannot change the data.

In general, the meaning of the indices is vendor-specific, but the indices for some slaves are specified by the PNO (German PROFIBUS user organization). This specification is called a profile and is intended to standardize these indices in order to permit consistent data interpretation in units from different vendors. At present, such profiles are available for NC/NR controllers, encoders, drives, and HMI devices.

C1 access

The Class_1 master is at the same time the cyclic master for the slave, i.e. it is physically and logically the same bus station. First it has to set the slave to the DataExchange state to be able to use non-cyclic services, i.e. the slave first has to be parameterized and configured. At present, S900 does not support non-cyclic C1 access.

C2 access

The Class_2 master is not cyclically exchanging data with the slave. It is logically another bus node than the Class_1 master, but physically the cyclic master can at the same time have a Class_2 master functionality.

The cyclic communication link is maintained or monitored continuously by sending the input and output data telegrams. A data link between the slave and the Class_2 master is non-cyclic, in the proper sense of the word, i.e. the link must be monitored explicitly through the master and the slave.

Multiple access

A separate SAP (Service Access Point) must exist for every non-cyclic link. In the slave, a buffer must be provided for intermediate data storage. Since the memory in the slave - or better said in the PROFIBUS ASIC - is limited, the number of possible simultaneous links is limited as well. S900 provides one SAP (plus buffer) for the Class_1 master and one SAP (plus buffer) for a Class_2 master. If the master attempts to set up a second link or a second Class_2 master is added, the slave will cancel any further communication setup.

S900 and DTM

The DTM (Device Type Manager) is used as the S900 configuration and parameterization tool. It can be integrated in stand-alone applications or engineering tools via a standardized interface (FDT = Field Device Tool). The FDT interface is not especially designed for the PROFIBUS and only supports the services for communication setup (MSAC2_Initiate), reading, writing, and communication interruption (MSAC2_Abort). Thus, the FDT and DTM do not use the full DPV1 functionality.

Diagnostics

S900 additionally provides all diagnostic information via slots and indices in a readable form. As a result, it is possible to extend the information content of the diagnostics far beyond the "standardized" scope. Among the special features are a time stamp for every event and a ring buffer for historical diagnostic messages.

Redundancy

Within one S900 station only bus coupler modules with the same revision level may be used.

PROFIBUS line redundancy

To increase the availability of multi-channel remote systems the communication link to these remote systems is implemented as a redundant link. For this purpose usually two PROFIBUS cables are laid via different routes to the PROFIBUS nodes. This way a redundant bus is established, and the two PROFIBUS cables are physically isolated, so that the interruption or a short circuit in one of the two cables does not influence the other cable. In the following text, the individual cables and the connected PROFIBUS nodes are referred to as a PROFIBUS line. A logical PROFIBUS structure with a common PROFIBUS address space is usually called a PROFIBUS trunk. A trunk or line can consist of one or several segments. Segmentation is done due to physical limitations of the PROFIBUS, and the number of nodes, the baud rate, and the cable lengths are taken into consideration. Since the S900 Communication Interface has only one PROFIBUS connector for reasons of space, cost, and energy balance (Ex), a separate Communication Interface must be used for each line to achieve line redundancy. PROFIBUS line redundancy only considers failures of the PROFIBUS line and assumes that both Communication Interfaces are fully operational. As the S900 is a PROFIBUS slave, both Communication Interfaces are passive PROFIBUS nodes (as seen from PROFIBUS), they must not be active on the bus on their own initiative. Furthermore, for the function within the S900 system, active and passive Communication Interface are distinguished. Active Communication Interface exchange cyclic or non-cyclic data with the PROFIBUS master(s) and control the I/O modules on the internal bus (CAN bus). The redundant Communication Interface, which in broad sense could also be called passive Communication Interface, communicates with the cyclic master exclusively for diagnostic purposes of the redundant PROFIBUS line. For improved scalability and matching to the master system there are two operating modes available at present.

- Off (0)
- Mode 1

As seen from the control system these redundancy operating modes work according to the single-machine model, i. e. the master/the control system only has to consider one slave in the engineering for the user data (I/O data) exchange. The decision for a redundancy toggle is made by the slave itself. Because of the master-slave relationship the slave cannot diagnose the lines

without the support of the master; therefore, additional functions are used in the master system depending on the selected operating mode.

The two lines are physically isolated via a voter (RLM01). For the DP master respectively the DCS the voter is not visible. When the master is transmitting, both lines are active. For receiving the line that receives the first valid character is switched through to the master. Thus, a master can communicate with the slaves of both lines without a connection between the lines. The voter treats both lines identically in all respects, so that different slaves (S900 systems) of a trunk – with the lines properly working – can be operated on different lines. Each CI920 of the I/O System S900 is allocated its own station address (or none, in case of LR_NONE). The station address of the redundant Communication Interface and the redundancy operating mode is passed to the passive Communication Interface by the active Communication Interface after it has started up.

If the PROFIBUS line fails (the one the active Communication Interface uses to handle the user data communication with the master), the active Communication Interface recognizes this fact. As a consequence, the two CI920 of the I/O System S900 swap their PROFIBUS station addresses. The previously passive Communication Interface becomes the active CI920 and vice versa. Now the master tries to include the active CI920 on the redundant line in the cyclic data exchange. Since the lines cannot be diagnosed during the start-up period and the redundant line could also be defective, the start-up (time) is monitored by the active CI920. When the active CI920 achieves the cyclic data exchange with the master, time monitoring is stopped, since now the line could be monitored. If the active CI920 does not achieve the cyclic data exchange with the master within the predefined start-up time (default setting = 8 s), another redundancy toggle is performed. For the time used for redundancy toggling and the startup time the module outputs retain their last valid values. If the cyclic data exchange could not be achieved after the first redundancy toggle, the originally active CI920 sets the module outputs to the parameterized safety condition/value after expiration of the startup time and after switching back to the originally active CI920. Retaining the input values during redundancy switching can only be ensured by the master system. The S900 ensures that already the first data telegram to the master will contain valid input data when entering the cyclic data exchange. This cannot be ensured for cyclic HART variables.

Redundancy Mode "Off" (0)

In redundancy operating mode off the redundant CI920 is in "passive reserve". The redundant (passive) CI920 does not have a valid station address and thus cannot be accessed via the PROFIBUS. This redundancy operating mode does not require any special behavior by the PROFIBUS master system. The redundant CI920 becomes active when

- the active CI920 is removed, or
- the PROFIBUS communication of the active CI920 fails longer than 15 s.

This operating mode features the following restriction:

- No diagnostics of the redundant PROFIBUS line.

Redundancy Mode "1"

In redundancy operating mode LR_MODE1 a certain behavior of the master is assumed, in order to be able to diagnose all failures of the PROFIBUS lines. The redundant CI920 becomes active when

- the active CI920 is removed, or
- the PROFIBUS communication of the active CI920 fails.

This redundancy operating mode features the following characteristics:

- Monitoring the active PROFIBUS connection in transmit and receive direction
- Diagnosing the redundant PROFIBUS connection in transmit and receive direction
- No additional engineering requirements,
- No additional bus load.

Prerequisites

- The CI920 must be parameterized accordingly for redundancy.
- The address of the passive CI920 must be a vacant node address.
- The PROFIBUS master must poll the passive CI920 (FDL status polling).
- Alternatively a minimum configuration can be set up for each passive CI920. This is optional and facilitates the diagnostics in the control

system. The configuration is limited to a CI920 user data (CIPB C), so that the bus load does not increase drastically.

- Both PROFIBUS lines must be sufficiently isolated.

> **Polling the passive CI920 is used for monitoring the second, passive bus line. Correct transmission of both CI920's can only be monitored by the DP master. If the DP master does not receive a response from the active CI920 for a request, the slave handler must be reset. This way the slave can detect that the DP master no longer recognizes the slave in the state "Data Exchange" and can react with a switching operation. Otherwise the DP master would continue to transmit Data Exchange telegrams and the slave cannot detect that its own transmission function is malfunctioning.**

Switching criteria

The DP watchdog of the active CI920 responds and

- the passive CI920 is ready to take over,
- the passive CI920 is at least in state "Baud_Control" (FDL status polling),
- the passive CI920 is present,
- the active CI920 has failed and see above.

Diagnostics / behaviour in case of failure

The only trouble-shooting procedures that may be necessary are related to configuration and parameter errors, provided that the S900 modules are used properly according to the specifications. S900 has special indicator LEDs allowing you to figure out errors and their possible reasons quickly. A PROFIBUS diagnostic message is provided for all errors indicated locally through the LEDs.

When a module is replaced (with an equivalent module), the new module is automatically configured/parameterized according to the following table:

Table 4-4 Data source in case of module replacement

Data	Source
CI920	Fieldbus master
Redundant CI920	Active CI920
I/O module	CI920
Behavior of outputs in error case	I/O module
Behavior of inputs in error case	Active CI920

S900 is a user-friendly and easily serviceable system. As you can see from the descriptions above, it allows for a 'plug-and-play' kind of replacement. No engineering tool is required.

Additionally, the system is provided with a simulation (forcing) option allowing you to perform important servicing and commissioning tasks. The simulation function serves for:

- testing the applications in the PLC or the OCS,
- simulating the actors if no PLC/OCS is available yet,
- avoiding unwanted error messages in the case of signal failures that may occur when a defective module is replaced.

Indicator LEDs

The CI920 has five LEDs on its front panel which indicate the following states.

Table 4-5 CI920 LEDs

LED		Description
1 (PW)	off	No power supply
	green	Power ok
	red	Serious error (e.g. checksum error in ROM)
2 (CA)	off	CAN not used
	yellow	CAN ready
	red	CAN error
3 (PB)	off	Slave is waiting for parameters / configuration data
	yellow	Slave in DataExchange state
	red	DP error, outputs on failsafe
	red blinking	Static diagnostics, outputs on failsafe
4 (RD)	off	CI920 is passive
	yellow	CI920 active
	yellow blink.	CI920 active, redundant CI920 not ready
5 (FD)	off	Configuration and parameters o.k.
	red blinking	Configuration or parameter error

PROFIBUS - diagnostics

Functional principle

When the slave is in the DataExchange status, it responds to the master's output data telegram with input data telegrams. The slave can enter special data in the telegram header to inform the master about existing diagnostic data. S900 reports all incoming and outgoing errors to the master, which then fetches the diagnostic buffer data with the next telegram. With a 25 ms pause between two diagnostic telegrams (or messages) the S900 ensures that a new buffer (with changed data) is only handed over to the PROFIBUS after the master has read the "old" buffer. This prevents that rapidly incoming and outgoing diagnostic data (e.g. line break signals in case of a loose contact) will overload the PROFIBUS with diagnostic telegrams.

Structure

The structure of the diagnostic telegram complies with the PROFIBUS DP standard with extension DPV1. Alarms are not supported. Thus, vendor-specific diagnostic messages are only possible in the channel-specific diagnostic part.

Module errors (incl. CI920) are transmitted as diagnostic data for channel 0.

Table 4-6 Diagnostics, overview

0..5	6..14	15..18	19..
Header	**Status diagnostics**	**Identifier-specific diagnostics**	**Channel-specific diagnostics**

Header

Octet 1: Station_status_1

The individual bits have the following meaning:

Bit 7 **Diag.Master_Lock**
The DP slave has been parameterized from another master. This bit is set by the DP master (Class_1), if the address in octet 4 is different from 255

and different from the own address. The DP slave sets this bit to zero.

Bit 6   **Diag.Prm_Fault**
This bit is set by the DP slave if the last parameter frame was faulty, e. g. wrong length, wrong Ident_Number, invalid parameters.

Bit 5   **Diag.Invalid_Slave_Response**
This bit is set by the DP master as soon as receiving a not plausible response from an addressed DP slave. The DP slave sets this bit to zero.

Bit 4   **Diag.Not_Supported**
This bit is set by the DP slave as soon as a function was requested which is not supported by this DP slave.

Bit 3   **Diag.Ext_Diag**
This bit is set by the DP slave. It indicates that a diagnostic entry exists in the slave-specific diagnostic area (Ext_Diag_Data) if the bit is set to one. If the bit is set to zero, a status message can exist in the slave-specific diagnostic area (Ext_Diag_Data). The meaning of this status message depends on the application and will not be fixed in this specification.

Bit 2   **Diag.Cfg_Fault**
This bit is set by the DP slave as soon as the last received configuration data from the DP master are different from those determined by the DP slave.

Bit 1   **Diag.Station_Not_Ready**
This bit is set by the DP slave if the DP slave is not yet ready for data transfer.

Bit 0   **Diag.Station_Non_Existent**
This bit is set by the DP master if the respective DP slave can not be reached over the line. If this bit is set, the diagnostic bits contain the state of the last diagnostic message or the initial value. The DP slave sets this bit to zero.

Octet 2: Station_status_2

The individual bits have the following meaning:

Bit 7   **Diag.Deactivated**
This bit is set by the DP master as soon as the DP slave has been marked inactive within the DP slave parameter set and has been removed from cyclic processing. The DP slave always sets this bit to zero.

Bit 6   **reserved**

Bit 5 **Diag.Sync_Mode**
This bit is set by the DP slave as soon as the respective DP slave has received the Sync control command.

Bit 4 **Diag.Freeze_Mode**
This bit is set by the DP slave as soon as the respective DP slave has received the Freeze control command.

Bit 3 **Diag.WD_On (Watchdog on)**
This bit is set by the DP slave as soon as its watchdog control has been activated.

Bit 2 **This bit is set to 1 by the DP slave.**

Bit 1 **Diag.Stat_Diag (static diagnostics)**
1: Diag.Stat_Diag (static diagnostics) If the DP slave sets this bit, the DP master shall fetch diagnostic information as long as this bit is reset again. For example, the DP slave sets this bit if it is not able to provide valid user data.

Bit 0 **Diag.Prm_Req**
If the DP slave sets this bit, the respective DP slave shall be reparameterized and reconfigured. The bit remains set until parameterization is finished. This bit is set by the DP slave.

If bit 1 and bit 0 are set, bit 0 has the higher priority.

Octet 3: Station_status_3

The individual bits have the following meaning:

Bit 7 **Diag.Ext_Diag_Overflow**
If this bit is set there exists more diagnostic information than specified in Ext_Diag_Data. For example, the DP slave sets this bit if there are more channel diagnostics than the DP slave can enter in its send buffer; or the DP master sets this bit if the DP slave sends more diagnostic information than the DP master can enter in its diagnostic buffer.

Bit 0 to 6: reserved

Octet 4: Diag.Master_Add

In this octet the address of the DP master is entered which has parameterized this DP slave. If none of the DP masters has parameterized the DP slave, the DP slave inserts the address 255 in this octet.

Octet 5 to 6 (unsigned16): Ident_Number

The manufacturer identifier is given for a DP-Device. This identifier can be used on one hand for verification purpose and on the other hand for exact identification.

Status diagnostics

The module status is indicated with two bits per slot (module). Channel errors are ignored.

Table 4-7 Status diagnostics

	7..6	5..0		
Octet 1	**Header**	**Length**		
	00	001001 = 9		
	7..0			
Octet 2	**Header module status**			
	0x82			
Octet 3	**Slot**			
	0x00			
	7..2			1..0
Octet 4	**Reserved**			**identifier**
				00: no differentiation 01: status active 10: status not active 11: reserved
	7..6	5..4	3..2	1..0
Octet 5	**I/O module 3**	**I/O module 2**	**I/O module 1**	**CIPB status**
	00: data valid 01: module error 10: wrong module 11: missing module	00: data valid 01: module error 10: wrong module 11: missing module	00: data valid 01: module error 10: wrong module 11: missing module	00: red. CIPB ok 01: red. CIPB failure 10: reserved 11: red. CIPB missing
Octet 6	**I/O module 7**	**I/O module 6**	**I/O module 5**	**I/O module 4**
	00: data valid 01: module error 10: wrong module 11: missing module	00: data valid 01: module error 10: wrong module 11: missing module	00: data valid 01: module error 10: wrong module 11: missing module	00: data valid 01: module error 10: wrong module 11: missing module
Octet 7	**I/O module 11**	**I/O module 10**	**I/O module 9**	**I/O module 8**
	00: data valid 01: module error 10: wrong module 11: missing module	00: data valid 01: module error 10: wrong module 11: missing module	00: data valid 01: module error 10: wrong module 11: missing module	00: data valid 01: module error 10: wrong module 11: missing module

Octet 8	**I/O module 15**		**I/O module 14**		**I/O module 13**		**I/O module 12**	
	00: data valid		00: data valid		00: data valid		00: data valid	
	01: module error		01: module error		01: module error		01: module error	
	10: wrong module		10: wrong module		10: wrong module		10: wrong module	
	11: missing module		11: missing module		11: missing module		11: missing module	
	7..2						1..0	
Octet 9	**not used**						**I/O module 16**	
	000000						00: data valid	
							01: module error	
							10: wrong module	
							11: missing module	

Identifier-specific diagnostics

One bit per slot (module) indicates, whether or not a diagnostic message exists for the respective slot.

Table 4-8 Identifier-specific diagnostics

	7..6		5..0					
Octet 1	**Header**		**Length**					
	01		000100 = 4					
	7	6	5	4	3	2	1	0
Octet 2	Slot 7	Slot 6	Slot 5	Slot 4	Slot 3	Slot 2	Slot 1	Slot 0
Octet 3	Slot 15	Slot 14	Slot 13	Slot 12	Slot 11	Slot 10	Slot 9	Slot 8
Octet 4								Slot 16

Channel-specific diagnostics

Three bytes are provided for every channel error. Only one error can be reported for one channel in a block. If more than one error occur in a channel, several blocks are put together.

Table 4-9 Channel-specific diagnostics

Bit	7..6	5..0
Octet 1	**Header**	**Slot**
	10	0..16
Bit	7..6	5..0
Octet 2	**I/O**	**Channel**
	00: reserved 01: input 10: output 11: input / output	0..8
Bit	7..5	4..0
Octet 3	**Channel type**	**Error code**
	000: reserved 001: 1 bit 010: 2 bit 011: 4 bit 100: 1 byte 101: 1 word 110: 2 words 111: reserved	see above

Error codes (according to DP standard)

0:      reserved
1:      short-circuit
2:      undervoltage (used for underflow)
3:      overvoltage (used for overflow)
4:      overload
5:      overtemperature
6:      wire-break
7:      high limit value exceeded
8:      low limit value fallen below
9:      error
10..15: reserved
16..31: vendor-specific (S900)

Error codes (CI920)

The meaning of the transmitted error codes can be different for every slot or module type of a modular slave. In the case of the I/O System S900 different interpretations are possible for the CI920 and for all I/O modules.

The error codes of the CI920 have the following meaning:

16:     ROM Error
17:     RAM Error
18:     EEPROM Error
19..21: reserved
22:     no CAN communication
23:     no redundant CAN communication
24:     error of power supply 1
25:     error of power supply 2
26:     restart upon watchdog reset (message indicated for 10 seconds)
27:     redundancy toggle has occurred (message indicated for 10 seconds)
28:     redundant CI920 is missing
29:     redundant CI920 is not ready
30:     redundant CI920 is defective
31:     no DP communication with CI920

Error Codes (I/O modules)

The error codes of the I/O modules have the following meaning:

19:     unknown module type (set configuration)
20:     unknown module type (actual configuration)
21:     reserved
22:     implausible (inconsistent) parameters
23..29: reserved
30:     HART status error
31:     HART error

5. Commissioning

S900 project planning using the GSD file

This section can only give you a general overview of how to proceed in this case, since the procedure considerably depends on the master system used. Please refer to the respective reference manuals for details. Systems like the ABB AC800F with its Control Builder F program provide to the user a comfortable user interface for convenient configuration and parameterization with plain text displays. Other systems like COM-PROFIBUS from Siemens use the same principle, which is described here briefly.

First the GSD file must be copied to a sub-directory under the configuration program or programming tool, i.e. the folder where all GSD files are stored (usually \GSD\...). Additionally, three other files for graphical presentation of the data are delivered with the GSD file.

In some cases, the extension of the database or hardware catalog with the new slaves / GSD files needs to be selected explicitly (Read GSD...). The setup of a new system including the master is described in detail in the respective reference manuals and can only be discussed here in brief.

Usually, the drag an drop function is used to add new slaves or modules to a modular slave like S900. First make a logical connection between the slave and the bus. Select the slave from the respective menu. To facilitate the search operations, the slaves are grouped in families. S900 belongs to the I/O-Devices family. When the slave is linked to the bus, a free bus address is assigned to it. Seen from the physical point of view, this corresponds to an S900 termination unit without any modules plugged in. The "empty" S900 station is then extended with the CI920 and the individual I/O modules.

The CI920 must be plugged in slot 0.

When the module is plugged in the master, the data traffic of the individual modules and, thus, of the entire station is known. As a result, the master and S900 can assign the input and output data of specific modules and channels in

the data telegram. The modules have to be parameterized then, to define features like line break monitoring or data formats. Refer to the S900 reference manual for details about setting the parameters.

When the project is released, the slave can communicate with the master and can be commissioned. The application in the master can access individual I/O data. Data processing takes place in the master application. In the case of AC800F and Control Builder F it is entered in graphical form in the function chart.

Commissioning with a master system that does not support GSD file import

The easiest way to configure and parameterize a S900 is to use the DTM. Another convenient way to configure a S900 slave is to import and interpret a modular GSD file (device data file).

In all other cases, this document helps you to parameterize a S900 by editing only few bytes of User_Parameters. This draft document describes parameterization mode 1. In this mode, the CI920 has 4 bytes of parameters, all I/O modules, and an empty slot with one byte as parameter. It is assumed that the user or reader is familiar with importing and setting up a PROFIBUS DP slave in the used master system or DCS.

Key features of parameterization mode 1

Generally, the settings made for one slot influence all channels of the corresponding module. Parameterization is done by selecting a number for a set of features or parameters.

How to configure an S900 station in mode 1

The configuration defines the "layout" of the station. S900 is a modular slave i.e. a slave consisting of several modules. In some parts of this document, the term "slot" is used as a synonym for "module".

The configuration is very important for both the slave and the master. It informs the slave about the arrangement of its I/O modules and enables it to perform a diagnostics if there should be a difference between target and real

configuration. The master needs the configuration to be able to interpret the I/O data of a slave.

In the first slot the CI920 has to be configured. There are two types or variants of a CI920. The difference is the number of I/O data for the CI920 itself. The first variant delivers or accepts no I/O data, the second one accepts and delivers two bytes each. The meaning of the I/O data is not further described here. Up to 16 I/O modules can be "plugged in" then.

Gaps between configured modules has to be filled with Empty Slots.

How to parameterize a S900 station in mode 1

To drive a PROFIBUS DP slave in the "DataExchange" state, the parameters and the configuration (in this order) must be sent by a master. In the engineering tool of the master the configuration must be defined first.

The parameter set consists of standardized parameters (EN50170) and of a set of User_Parameters. The interpretation of the User_Parameters is always vendor-specific. In the standardized parameter part, only some simple settings need to be made to set up correct PROFIBUS communication. This part is set up automatically on nearly all master systems. The User_Parameters are defined in the GSD file and are described in this document.

The first three bytes must be set constantly to 0x00, 0x00 and 0x00. Check, if your engineering tool does this correctly!

Then four bytes must be set for the CI920 The meaning of the individual bits is described in the corresponding sheets. It is easier to edit the numbers in hexadecimal format, but not all masters accept this.

In position 7 of the User_Parameters the parameter data for the first I/O module begins. There is one sheet for every kind of module. Some modules are physically equal, but differ in the number of I/O data! This is the reason why sometimes the "same" module comes with two variants (see AI4H-Ex, for example). The one byte parameter is divided into two nibbles of four bits each. The nibbles are called subsets.

Subset one, which corresponds to bits 4 to 7 of the data byte, consists of the error monitoring and failsafe behavior. This subset is equal for each I/O module! First select a line which includes all requested parameters. The first

column delivers the hexadecimal number for this subset. This number is the higher order part of the byte to "construct".

The meaning of subset two, which corresponds to bits 0 to 3 of the data byte, is module-specific. The procedure is the same as for subset one: Search the line with all requested parameters and take the subset number of the first column. Add this number as the lower order part to the byte to "construct". Only the shown subset numbers are valid, all others are denied by the S900 on download. Then edit this byte in the corresponding field of the master engineering tool.

> **Note that an empty slot also has one User_Parameter byte which must be set to zero!**

Commissioning the S900 with Composer/Melody

To commission the S900 on a Symphony / Melody system the DTM is required. The DTM serves the I/O data mapping and the parameterization and configuration of the station. All input values are processed with a status information. Nevertheless the scaling of analog input values must be done manually in the input and output function blocks in the Composer.

- For 0..20 mA inputs use range 0 – 40000.0 (to get 0..100%), unipolar
- For 4..20mA inputs use range 8000.0 – 40000.0 (to get 0..100%), unipolar
- For temperature inputs use range 0.0 – 20.0 (to get K), unipolar
- For temperature inputs use range 5444.0 – 5484.0 (to get °C), bipolar

Commissioning the S900 with AC800M

S900 comes with alle required hardware definition files. First an empty termination unit (S900) has to be configured below the PROFIBUS interface of the Controller. The CIPB (CI920S) has to be configured on position 0 inside the S900 slave.

Diagnostics

Standard PROFIBUS diagnostics can not be processed by AC800M. Nevertheless via the status supervision an input value can be detected as valid

or not valid in the Controller. The alternative way to get diagnostics information is the use of SMART VISION with the S900 DTM.

Status supervision

All S900 input values (digital and analogue) appear with a status information. For digital values the status is processed as a further input signal. This must be done in the function plan explicitly. For analogue input values the status delivered by S900 is combined with the status information produced by AC800M. An unvalid input value by S900 leads to an error for the value in the application.

6. Appendix

Using CI920 in CB220

All S900 I/O modules and the CI920 can be used either on the termination unit TU921 or in the field device CB220. The scope of this document is the use on the TU921. For use at CB220 the following deviations have to be considered.

- The special properties of CB220 are described in manual "S900 Manual CB220", document number 3BDD010437.

- PROFIBUS addresses can be set from 1 to 99 only. The adjustment of the PROFIBUS address is described in CB220 manual.

- The parameters 'Power suppy redundancy' and fieldbus redundancy must be set of single / off. These are the default values too. If redundancy is parameterized for a CB220 it will report redundancy errors at PROFIBUS diagnosis, but nevertheless the station would enter the cyclic data exchange state.

- The chapter redundancy of this document is not relevant for CB220.

- The CB220 offers 4 I/O module slots only, compared to 16 slots of the TU921 termination unit. During configuration in the master's engineering tool either by GSD or DTM (**D**evice **T**ype **M**anager) the user has to observe the slot limit.

- The PROFIBUS diagnosis to cyclic master and DTM's diagnosis view assumes a termination unit with 16 slots. If the target configuration contains 4 or less I/O modules the remaining slots 5..16 will not report errors at CB220.