auma®
Solutions for a world in motion

Actuator controls

AUMATIC AC 01.1/ACExC 01.1
Foundation Fieldbus

Fieldbus Foundation

Read operation instructions first

- Observe safety instructions.

Purpose of the document:

This document is intended to support the system integrator in integrating the fieldbus interface into the DCS.

Reference documents:

- Operation instructions (assembly, operation, commissioning) for actuator
- (Operation and setting) manual AUMATIC AC 01.1/ACExC 01.1 Foundation Fieldbus
  Can be downloaded from the Internet (www.auma.com) or ordered directly from AUMA (addresses from page 82).

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1. Safety instructions

1.1. General notes on safety

Standards/directives

AUMA products are designed and manufactured in compliance with recognised standards and directives. This is certified in a declaration of incorporation and a declaration of conformity.
The end user or the contractor of the plant must observe national laws and regulations regarding assembly, electrical connection, and commissioning on site.
This includes in particular the fulfilment of the requirements in standards and directives for potentially explosive areas, such as e.g. EN 60079-17 “Inspection and maintenance of electrical installations in hazardous areas (other than mines) (IEC 60079-17:2002)”.
This includes, in particular the observance of the applicable configuration directives for fieldbus applications.

Safety instructions/ warnings

All personnel working with this device must be familiar with the safety and warning instructions in this manual and observe the instructions given.
Safety instructions and warning signs on the device must be observed to avoid personal injury or property damage.

Qualification of staff

Assembly, electrical connection, commissioning, operation, and maintenance must be carried out exclusively by suitably qualified personnel authorised by the end user or contractor of the plant.
Prior to working on this product, the staff must have thoroughly read and understood these instructions and, furthermore, know and observe officially recognised rules regarding occupational health and safety.
Work performed in potentially explosive atmospheres is subject to special regulations which have be observed. The end user or contractor of the plant are responsible for respect and control of these regulations, standards, and laws.

Commissioning

Prior to commissioning, it is important to check that all settings are in compliance with the requirements of the application. Incorrect settings might present a danger to the application, e.g. cause damage to the valve or the installation.
The manufacturer will not be held liable for any consequential damage. Such risk lies entirely with the user.

Safe operation

Prerequisites for safe and smooth operation:

- Correct transport, proper storage, mounting and installation, as well as careful commissioning.
- Exclusively operate the device if it is in perfect condition while observing these instructions.
- Immediately inform about any faults and damage and allow for corrective measures.
- Observe recognised rules for occupational health and safety.

Protective measures

The end user or the contractor are responsible for implementing required protective measures on site, such as enclosures, barriers, or personal safety equipment for the staff.

Maintenance

Any device modification requires the consent of the manufacturer.

1.2. Range of application

AUMA actuator controls are exclusively designed for the operation of AUMA actuators.

Other applications require explicit (written) confirmation by the manufacturer.

The following applications are not permitted, e.g.:

- motor activation
- pump activation

No liability can be assumed for inappropriate or unintended use.

Observance of these operation instructions is considered as part of the device's designated use.

1.3. Warnings and symbols

The following references and symbols are used in these instructions:

NOTICE

Potentially hazardous situation. Failure to observe this warning may result in property damage.

Information

The term **Information** preceding the text indicates important notes and information.

For assembly, operation, and commissioning, observe the additional safety and warning instructions of the reference documents (page 2).

Symbol for CLOSED

Symbol for OPEN

➡ **Via the menu to parameter**
Describes the path within the menu to the parameter. By using the push buttons of the local controls you may quickly find the desired parameter in the display.

⬇ **Description of the parameter settings/indications**
Describes the setting/viewing possibilities of a parameter.

⇩ **Step by step**
Provides a detailed description of each step for setting/viewing the parameter.

2. General information regarding Foundation Fieldbus

For the exchange of information among automation systems and between automation systems and the connected distributed field devices, the use of serial fieldbus systems as communication system is state-of-the-art. Thousands of applications have proved impressively that, in comparison with conventional technology, cost savings of up to 40 % in wiring, commissioning, and maintenance are achieved by using fieldbus technology. While in the past the fieldbus systems used were often manufacturer specific and incompatible with other bus systems, the systems employed today are almost exclusively open and standardized. This means that the user does not depend on individual suppliers and can choose within a large product range the best product at the most competitive price.

Historical development

In 1992, an international group, the ISP (Interoperable Systems Project) was founded with the intention to create an internationally uniform fieldbus standard for use in hazardous environments. At the same time, the manufacturers and users of the French FIP (Flux Information Process; previously: Factory Instrumentation Protocol) established the international user organisation WorldFIP. Together with the FIP North America, they were a strong counterweight to the ISP consortium. In 1994, for technical, economic, and political reasons, the ISP and the WorldFIP merged to form the Fieldbus Foundation. The aim of the Fieldbus Foundation was and is to create a single, international fieldbus standard for hazardous environments which will find widespread use as IEC standardised fieldbus. The website of the Fieldbus Foundation is www.fieldbus.org.

User organisation

The Fieldbus Foundation is an independent non-profit organisation. The mission is to develop and support a global, uniform fieldbus infrastructure for automation tasks – the Foundation Fieldbus. Members include users and manufacturers of field devices and automation systems. The Fieldbus Foundation contains various workshops which are responsible, among others, for technical support, marketing, and support of the members. Website of the Fieldbus Foundation: www.fieldbus.org.

Certification of the devices

The Fieldbus is an open bus standard which enables devices of different manufacturers to be integrated in one system and, if required, interchanged (interoperability). This is only feasible when all devices exactly meet the specification. If the devices are approved by Fieldbus Foundation, this implies a guarantee for the user and manufacturer that those devices comply with the specification.

2.1. Performance features

The Foundation Fieldbus provides a broad spectrum of services and functions compared to other fieldbus systems:

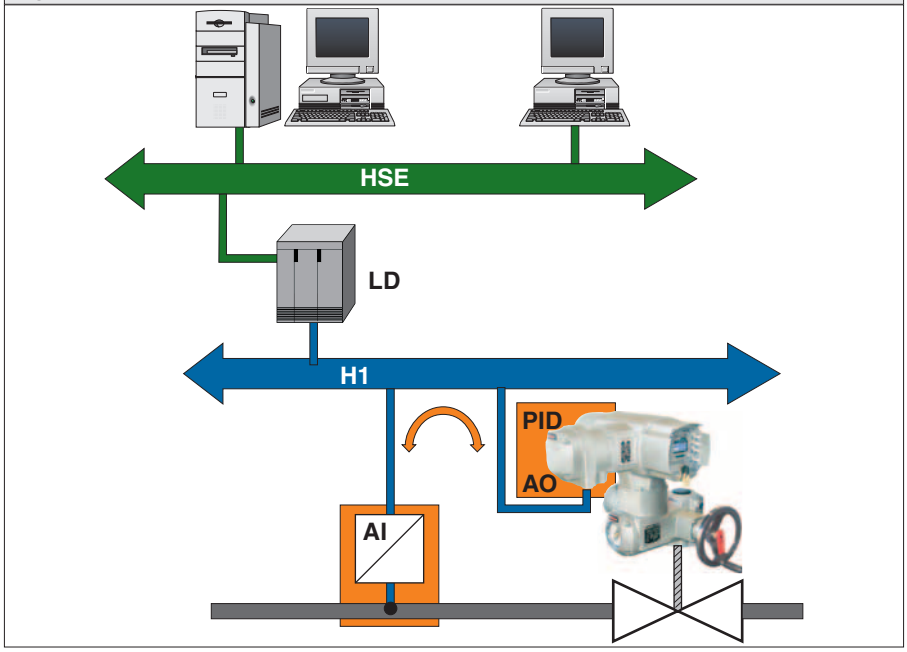
- Bus-powered field devices
- Line or tree topology
- Deterministic (predictable) dynamic behaviour
- Distributed data transfer (DDT)
- Standardised block model for uniform device interfaces (interoperability, interchangeability)
- Trend functions and alarm treatment
- Flexible extension options based on device descriptions
- Intrinsic safety for use in hazardous areas (option)

Decentralised process data processing

The distributed data transmission within the Foundation Fieldbus network enables individual field devices to independently perform automation tasks via standardised function blocks. If a field device contains e.g. the PID function block, it is able to independently control a process variable. This automation decentralisation from the automation to the field level relieves the central process control.

Typical Foundation Fieldbus structure:

Figure 1



HSE	FF bus based on high speed Ethernet		Actuator controls with function blocks:
H1	FF bus based on H1	PID	Process controller
LD	Linking device	AO	Analogue output (valve setpoint)
		AI	Analog Input (e.g. flow rate measured by sensor)

2.2. Layered communications model

The structure of Foundation Fieldbus is based on the ISO/OSI reference model (**I**nternational **S**tandards **O**rganisation - **O**pen **S**ystems **I**nterconnection). This model consists of 7 layers. Foundation Fieldbus just uses three layers:

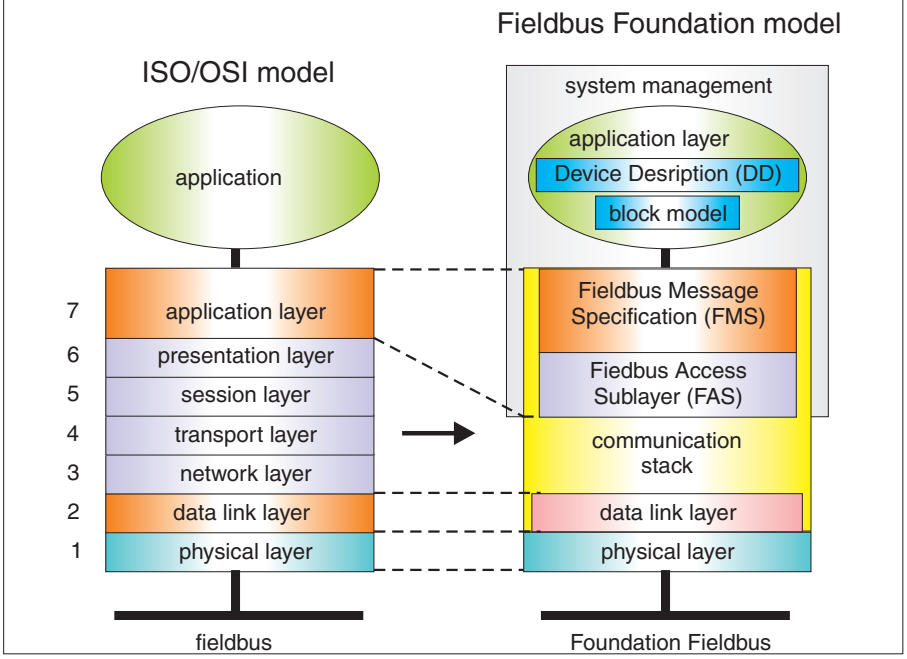
- Layer 1: Physical layer
- Layer 2: Data link layer
- Layer 7: Application layer

As is the case for many other bus systems, layers three to six are not used. Layer 7 is subdivided into a Fieldbus Access Sublayer (FAS) and a Fieldbus Message Specification (FMS). The Communication Stack covers the tasks of layers 2 and 7.
The special feature of Foundation Fieldbus is the device-dependent application layer, placed above the 7th layer. Whereas the actual application process is not determined for the ISO/OSI model, the Fieldbus Foundation defines a special application layer. This layer contains a block model with function block and a device description (DD). Depending on which blocks are implemented in the block model of a device, users can access a variety of services.

Thus, the Foundation Fieldbus specification consists of 3 main function elements:

- Physical layer
- Communication stack
- Application layer

Figure 2



2.3. Physical layer

The lowest bus level, the physical layer, complies with the IEC 61158-2 standard. This layer specifies the physical connection to the fieldbus network and how to solve communication tasks.
Foundation Fieldbus uses two systems for the communication. For communicating and for directly connecting the field devices, the low speed H1 version is implemented; the fast HSE version, based on Ethernet, is used within the control system.

2.3.1 H1 bus

The following summary provides a brief overview of the features and functions of the H1 bus. For more details, refer to the various Application Guides of the Fieldbus Foundation (e.g. AG 140, AG 163).

- Data transfer: Manchester coding
- Data transfer rate 31.25 kbit/s (default setting, cannot be modified).
- Requirements for flawless communication: Sufficient power supply for the field devices, i.e. minimum 9 volts for each device. Software tools are available for network planning, calculating the resulting currents and terminal voltage on the basis of the network topology, of the resistivity, and the supply voltage.
- Field device connection via H1 version. The Foundation Fieldbus power supply unit is connected to the bus line in the same way (parallel) as a field device. Field devices powered by supply sources other than the bus must be additionally connected to their own supply sources.
- The maximum power consumption of current consuming devices within the H1 version must be lower than the electric power supplied by the Foundation Fieldbus power supply unit.
- Network topologies: Line topology; when using junction boxes, also star, tree or a combination of different topologies.
- Device connection: Often via short spurs to enable connection/disconnection of the devices without interrupting communication to other users.
- Maximum length of a spur: 120 m, depending on the number of spurs used as well as the number of devices per spur.
- Maximum length of an H1 segment without repeater: 1,900 m.
- Maximum length of an H1 segment using maximum 4 repeaters:
  5 x 1,900 m = 9.5 km.
  All spurs from the field devices to the junction box have to be included in the total length calculation.
- Number of bus users per segment: In non-intrinsically safe areas: Max. 32, in explosion-hazardous areas, this number is reduced to significantly fewer devices (due to power supply limitations).
  Based on the available H1 bandwidth, the typical number of devices per segment is max. 10 – 14 devices per segment.
- Fieldbus cable: Type A (recommended), only this type is specified for the maximum cable length of 1,900 m.
- Termination: Two terminators per bus segment, typically one at each end of the longest fieldbus line.
- Bus cable shielding: If shielded cables are used (recommended), the shield may only be grounded at one single point within the segment (typically near the Foundation Fieldbus power supply).

2.3.2 High Speed Ethernet (HSE)

HSE is based on standard Ethernet technology. The required components are therefore widely used and are available at comparatively low costs. The HSE data transfer speed runs at 100 Mbit/s and can be equipped with both copper cables and optical fibre cables.
The Ethernet operates by using random (not deterministic) CSMA bus access.
This method cannot be applied to all automation applications because, sometimes, real-time capability is required. The extremely high transmission rate enables the HSE to respond sufficiently fast when the bus load is low and only few devices are connected. With respect to process automation demands, real-time requirements are met in any case.
If the bus load must be reduced due to the multitude of connected devices, or if several HSE sub-networks are to be combined to create a larger network, Ethernet switches must be used. A switch reads the target address of the data packets that must be forwarded and then passes the packets on to the associated sub-network. This way, the bus load and the resulting bus access time can be controlled as to adapt it ideally to the respective requirements.

2.3.3 Connection between H1 and HSE

To connect the comparatively slow H1 segments to the HSE network, linking devices are required (refer to figure 1).
The linking device adapts the data transfer rates and the data telegrams of both networks while considering the direction of transmission. This way, powerful and widely branched networks can be installed in larger plants.

2.3.4 Data transmission and power supply

Within the Foundation Fieldbus network, a device transmitting data typically varies its power consumption by ±10 mA at 31.25 kbit/s to generate a typical ± 0.5 V voltage change at a power supply with 50 Ohm impedance. This voltage change is modulated onto the 9 – 32 V DC H1 power supply.

2.4. Communication stack

The field devices used with Foundation Fieldbus are capable of independently assuming automation tasks, i.e.:

- Each controlling field device can directly exchange data with other devices (e.g. reading measuring values, forwarding control values).
- All field devices send and receive data at pre-defined points in time.
- It is ensured that two or more devices never access the bus simultaneously.

To meet these requirements, the Foundation Fieldbus needs a central communication control system (Link Active Scheduler = LAS).

2.4.1 Link Active Scheduler - LAS

A field device performing the Link Active Scheduler (LAS) function controls and schedules the bus communication. It controls all bus activities by means of various data telegrams that it sends to the available devices. Since the LAS also continuously polls unassigned device addresses, it is possible to connect devices during operation and to integrate them in the bus communication.

Devices which can be used as LAS are called Link Master Devices. Basic devices do not have LAS capacity.

In a redundant system containing several link master devices, only one link master takes over the LAS task. If the active LAS device fails, another link master device will take over (fail operational design).
The LAS continuously transmits and updates the live list.

If a device is removed from or added to the list, the LAS transmits this change to all link master devices (broadcast message). This way, all link masters maintain a copy of the current live list so that they can become the LAS without any loss of information.

2.4.2 Communication control

The communication services of the FF specification use scheduled and unscheduled data transmission. Time-critical tasks, such as the control of process variables, are exclusively performed by scheduled services, whereas programming and diagnostic functions are carried out using unscheduled communication services.

Scheduled data transmission

To solve communication tasks in time and without access conflicts, all time-critical tasks are based on a strict transmission schedule. This schedule is created by the Foundation Fieldbus system operator during the configuration of the FF system.
The LAS periodically broadcasts a synchronisation signal (TD: Time Distribution) on the fieldbus so that all devices have exactly the same time information. In scheduled transmission, the point in time and the sequence of data telegrams are exactly defined.

This is why it is called a deterministic system.

For each task to be executed, a certain time frame is scheduled.
Based on this schedule, a transmission list is generated which defines when a specific field device is prompted to send its data. Upon receipt of a special trigger telegram (CD: Compel Data), the respective device (publisher) broadcasts the data in the buffer of all devices which are configured to receive this data (subscriber).
This type of transmission is therefore called the “Publisher/subscriber” method.

Unscheduled data transmission

Device parameters and diagnostic data must be transmitted when needed, i.e. on request. The transmission of this data is not time-critical. For such communication tasks, the Foundation Fieldbus offers the unscheduled data transmission.
Permission for a certain device to use the fieldbus for unscheduled communication tasks is granted by the LAS device, provided that no scheduled data transmission is active.
Every device may use the bus as long as required until it either returns the bus access (token), or until the maximum granted time to use the token has elapsed.
Unscheduled transmission offers two data transfer methods: “Client/Server” to adapt device setting, configuration, and upload/download of diagnostic data as well as ‘Report Distribution’ to send alarms.

2.4.3 Services

The Fieldbus Access Sublayer (FAS) and the Fieldbus Message Specification (FMS) layer form the interface between the data link layer and the user application (refer to figure 2). The services provided by the FAS and FMS are invisible for the user. However, performance and functionality of the communication system considerably depend on these services.

Fieldbus Access Sublayer (FAS)

FAS services create Virtual Communication Relationships (VCR) which are used by the higher-level FMS layer to execute its tasks. VCRs describe different types of communication processes and enable faster processing of the associated activities. Foundation Fieldbus communication use the three different VCR types as follows (table 1).

Table 1

Client/Server	Report Distribution	Publisher/Subscriber
User communication	Events, alarms, trends	Transmitting process data
Setpoint changes Change in operation mode and device data Upload/download Adapting alarm values Remote diagnostics	Send process alarms to user console Transferring trend data for long term data logging.	Transfer process values from sensors and other devices

The publisher/subscriber VCR type is used to transmit the input and output data of function blocks. As described above, scheduled data transmission is based on this type of VCR.

The Client/Server VCR type is the basis for operator initiated requests, such as setpoint changes, adaptations and change of control parameters, diagnostics, device upload, and download, etc.

Report Distribution is used to send alarms or event notifications to the operator consoles or similar devices. Client/Server and Report Distribution data transmission is unscheduled, due to the fact that the time of transmission cannot be foreseen and therefore not be scheduled.

Fieldbus Message Specification (FMS)

FMS provides the services for standardised communication. Data types that are communicated via the fieldbus are assigned to certain communication services. For uniform and clear assignment, object descriptions are used. Object descriptions contain definitions of all standard transmission message formats as well as application-specific data. Special, predefined communication services are available for each object type.

Object descriptions are collected together in a structure called object dictionary.

2.5. Application layer

An important criterion for a fieldbus system to be accepted by the market is the interoperability of the devices. Interoperability means the capability of devices of different manufacturers to communicate with each other. In addition, it must be ensured that a device from one manufacturer can be substituted with that of another.
This requires an open protocol specification which defines uniform device functions and application interfaces. Other network users and application programs can use these interfaces to access the functions and parameters of the field devices. The Foundation Fieldbus meets these requirements by means of standardised function blocks and device descriptions.

2.5.1 Block model

Foundation Fieldbus assigns all functions and device data to three different types of blocks:
- Resource block
- One or several function blocks
- Several transducer blocks.

The assignment depends on the device function type.

Resource block

The resource block describes characteristics of a fieldbus device, e.g. device name, manufacturer, serial number, hardware and firmware version, etc.

Function blocks

Function blocks describe the device functions and define how these can be accessed. The schedules of the scheduled data transmission are based on these function blocks. Each block (including the pertaining input and outputs) has a definite task. Each device is equipped with at least one function block.
The FF specification has defined standard function blocks which can be used to describe all basic functions. They are listed below:

- AI: Analog Input
- AO: Analog Output
- DI: Discrete Input
- DO: Discrete Output
- PID: Proportional/Integral/Derivative

Transducer blocks

Transducer blocks expand the complexity and the application options of a device. Their data enables the input and/or output parameters of a function block to be influenced. Measuring and positioning data can be calibrated and reset, characteristics can be linearised or physical units can be reset using additional process data.

Further objects

Besides the three block types, the following additional objects are defined within the block model:
Link objects define the links between different function blocks within the field devices as well as across the fieldbus network.
Alert objects allow reporting alarms and events on the fieldbus.
Trend objects allow trending function block data for access and analysis by higher-level systems.
View objects are predefined groups of data and block parameter records that can be used to group and display the parameters according to their tasks: Process control, configuration, maintenance, additional information.

2.5.2 Device descriptions

During start-up and maintenance as well as when performing diagnostic functions, an open communication system must ensure that higher-level control computers or control systems can access all field devices and that respective controls are available.
The device descriptions (DDs) contain the necessary information to fulfill these requirements. They provide information needed to understand the meaning of the device data and display them correctly on the operator console.

2.5.3 System management

The system management of each device has the following tasks:

- Synchronisation of relevant device activities, i.e. according to the predefined transmission schedule.
- Cyclic processing of the transmission list (LAS only) within the predefined schedule.

Further tasks performed by the system management:

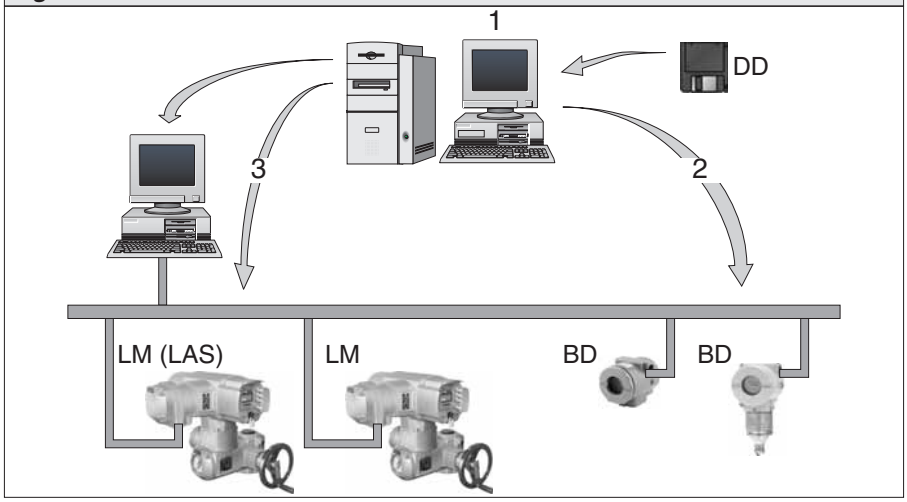
- Automatic assignment of LAS function to another Link Master if the active LAS fails.
- Synchronisation of time information
- Automatic address assignment for new devices within the communication network

The automatic assignment of a provisional device address allows the assignment of a clear and unambiguous device address during commissioning while communication is active. For this address assignment procedure, special default addresses are reserved allowing to access the new devices which are not yet configured. A new device is integrated into the communication network after assigning a device tag as well as a new, unambiguous and final bus address. The default address used is then available again for the assignment of further devices still due to be configured.

2.5.4 System configuration

Scheduled communication as well as all fieldbus devices must be configured before their first start-up (figure 4). This requires a configuration tool, e.g. the NI-FBUS Configurator by National Instruments.

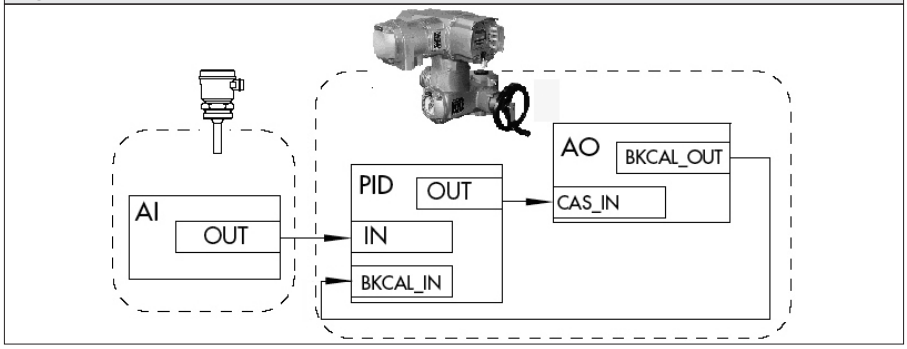
Figure 4



1 Configuration device
2 Configurating basic devices
3 Configurating LAS and link master

Prior to the actual commissioning, the Device Description (DD) for all devices to be configured must be installed in the configuration tools. The configuration software must either be able to access the device descriptions in the predefined libraries, or the device descriptions must be downloaded via external data carriers.
The configuration software helps to determine how and with which devices the measurement and control tasks of a plant are processed by connecting the function blocks of the field devices. This task can be performed using a graphical user interface. For this, just connect the inputs and outputs of the corresponding block symbols and define the block behaviour.
Figure 3 shows an example for a filling level control. The sensor output value is connected to a PID function block. This block can be provided e.g. by actuator controls. The subsequent analogue output acts on the actuator positioner for filling level control.

Figure 3



Filling level sensor with function block:
AI Analog Input (filling level)

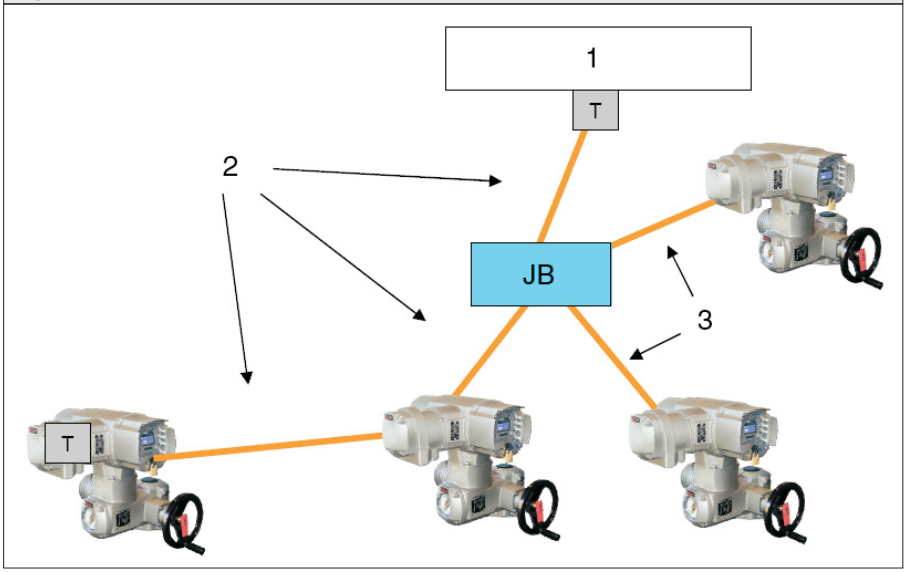
Actuator controls with function blocks:
PID Process controller
AO Analog Output

2.6. Topology

Several structures are available for Foundation Fieldbus:

Point-to-point topology, whereby only one device is connected to each line.
Bus with **spurs**; for this structure, the fieldbus devices are connected to the bus segment via spurs.
Line topology; for this structure, the fieldbus cable of a segment is led from device to device and connected to the terminals of each fieldbus user. Due to the AUMA plug/socket connector, installations with AUMA actuators implementing this topology can easily and individually be disconnected from the network without impairing the availability of the remaining segment.
Tree topology; for this structure, the devices of one fieldbus segment are connected to a common junction box via separate fieldbus cables. The maximum spur length must be observed when implementing this topology.
It is furthermore possible to combine the topology options mentioned.

Figure 5



1 DCS
2 Trunk
3 Spurs
JB Junction box

Spurs or tee connectors are possible for Foundation Fieldbus.
The possible fieldbus line length is determined by the type of cable, the cross section, and the type of the bus supply.

Cable length = trunk length + total spur length
Maximum length = 1,900 metres with cable type A

By using up to four repeaters, a maximum of 5 x 1,900 m = 9,500 m can be achieved.
A terminator is to be installed at both ends of the main trunk.

Table 3	
Number of devices	**Permissible spur length**
The number of devices possible on a fieldbus depends on the power consumption of devices, the type of cable used, the use of repeaters, etc. For details please refer to Physical Layer Standard	Permissible spur length for a device per spur – any further device reduces the permissible spur length by 30 metres
25 – 32	1 m
19 – 24	30 m
15 – 18	60 m
13 – 14	90 m
1 – 12	120 m

For details regarding the different topology options, please refer to the Application Guides published by Fieldbus Foundation:
AG-140 31.25 kbit/s Wiring and Installation
AG-163 31.25 kbit/s Intrinsically Safe Systems
AG-170 Function Block Capabilities in Hybrid/Batch Applications
AG-181 System Engineering Guidelines

Bus cables

Various types of fieldbus cables can be applied for Foundation Fieldbus. The following table lists the cable types specified by the IEC/ISA 61158-2 Physical Layer Standard.
Type A is the preferred fieldbus cable. This cable should be used in new installations. However, other cable types may be used for the fieldbus wiring (e.g type B, C, and D). Their disadvantage is the reduced cable length; therefore, their use is not recommended.

Table 2				
	Type A (Reference)	**Type B**	**Type C**	**Type D**
Cable design	Twisted conductor pair	One or multiple twisted conductor pairs, overall shield	Multiple twisted pairs, not shielded	Multiple non-twisted pairs, not shielded
Conductor cross-section (nominal)	0.8 mm² (AWG 18)	0.32 mm² (AWG 22)	0.13 mm² (AWG 26)	1.25 mm² (AWG 16)
Loop impedance (DC current)	44 Ω/km	112 Ω/km	264 Ω/km	40 Ω/km
Wave resistance at 31.25 kHz	100 Ω ± 20 %	100 Ω ± 30 %	not specified	not specified
Wave attenuation at 39 kHz	3 dB/km	5 dB/km	8 dB/km	8 dB/km
Capacitve asymmetry	2 nF/km	2 nF/km	not specified	not specified
Group delay distortion (7.9 – 39 kHz)	1.7 µs/km	not specified	not specified	not specified
Degree of shield coverage	90 %	not specified	not specified	not specified
Recommended network expansion (incl. spur line)	1,900 m	1,200 m	400 m	200 m

3. Commissioning

3.1. Introduction

The AUMATIC with Foundation Fieldbus is commissioned via the fieldbus network. This includes both device tag and device address setting as well as the function block application configuration and network configuration.

3.2. Function blocks of the AUMATIC

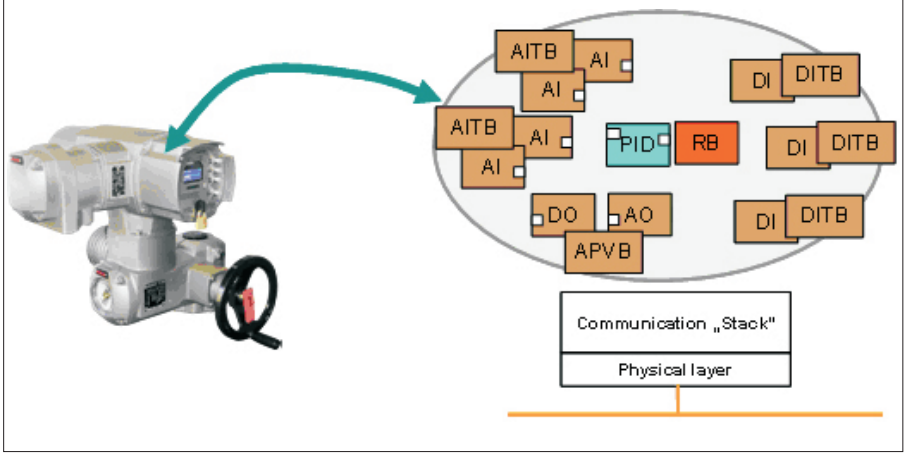
Input and output parameters of function blocks can be connected to perform the automation task via Foundation Fieldbus.
The AUMATIC contains the following function blocks:

Table 4

No.	Abbreviation	Description
1	RB	Resource Block
4	AI	Analog Input function block
2	AITB	Analog Input Transducer Block
3	DI	Discrete Input function block
3	DITB	Discrete Input Transducer Block
1	AO	Analog Output function block
1	DO	Discrete Output function block
1	APVB	Advanced Positioner Valve Basic transducer block

Each discrete input function block is connected to a discrete input transducer block.
Two analog input function blocks are connected to one common analog input transducer block. The discrete output and the analog output function block also have a common transducer block (APVB).
No transducer blocks are required for the PID function block or the resource block.

Figure 6



3.2.1 Operation commands

Electric operation via Foundation Fieldbus of an actuator with AUMATIC can be performed via the Analog Output function block (AO) for setpoint operation commands or, alternatively, via the Discrete Output function block (DO) for OPEN - STOP - CLOSE commands.
Both function blocks are connected to the Advanced Positioner Valve Basic transducer block (APVB). The APVB converts the Foundation Fieldbus data received via DO or AO into signals to change the actuator position.

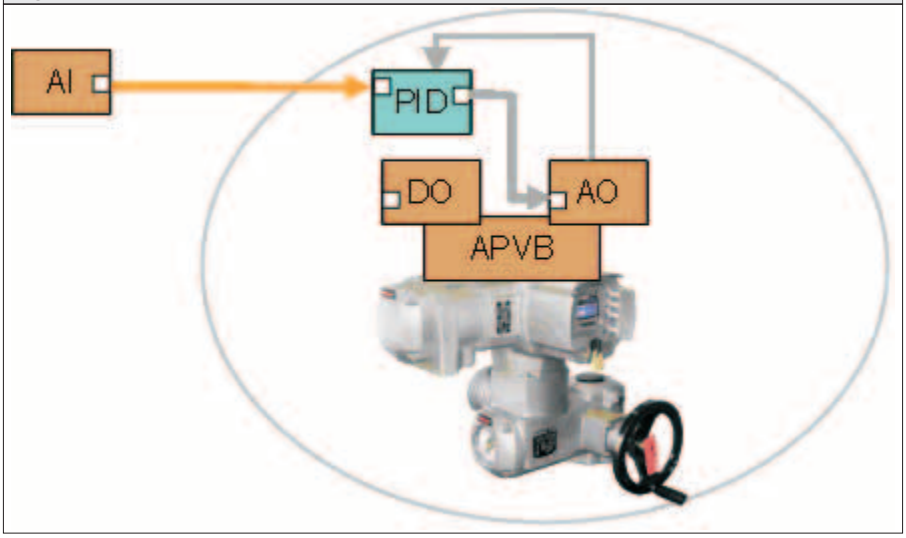
Information

If the actuator is driven via the AO for setpoint operation commands, the DO must be set to Out_of_Service (OOS); if the actuator is driven via the DO for the OPEN - STOP - CLOSE commands, the AO must be set to Out_of_Service (OOS).

Operation commands via the analog output function block

The integral PID function block can be used as controller function block to reduce the number of required external VCRs. This is not imperative. The PID function block can be activated within another external device, e.g. the DCS; however, an additional VCR is then required for feedback from the AO to the PID.

Figure 7



The AO function block accepts setpoints between 0 and 100 %.
A setpoint of 0% signifies that the actuator fully closes, a setpoint of 100 % signifies that the actuator fully opens.

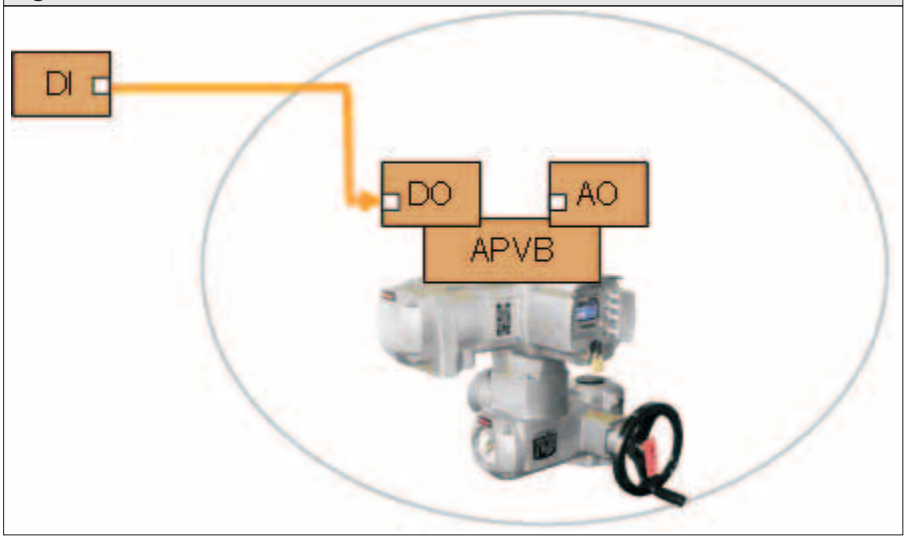
Operation commands via the discrete output function block

The operation commands of the DO function block are coded as follows:

Table 5

Discrete state	Operation command	Description
0	CLOSE	Run CLOSE
1	OPEN	Run OPEN
2	STOP	Actuator stops
3	STOP	Actuator stops
4	Intermediate pos.1	Actuator directly runs to intermediate position 1
5	Intermediate pos.2	Actuator directly runs to intermediate position 2
6	Intermediate pos.3	Actuator directly runs to intermediate position 3
7	Intermediate pos.4	Actuator directly runs to intermediate position 4
8	Intermediate pos.5	Actuator directly runs to intermediate position 5
9	Intermediate pos.6	Actuator directly runs to intermediate position 6
10	Intermediate pos.7	Actuator directly runs to intermediate position 7
11	Intermediate pos.8	Actuator directly runs to intermediate position 8

Figure 8



3.2.2 Feedback signals from the AUMATIC

The AUMATIC is able to signal its status by means of several different function blocks.
The Analog Input function blocks (AI) are used to transmit analogue data, the Discrete Input function blocks (DI) are used to transmit binary information.

Feedback signals via the analog input function blocks

The AUMATIC is equipped with 4 analog input function blocks:

- AIFB_1 is used to transmit an external 0 – 20 mA input signal and is connected to the first analogue input, identified by ANIN1+ and ANIN1– on the wiring diagram (option).
- AIFB_1 is also used to transmit an external 0 – 20 mA input signal and is connected to the second external analogue input, identified by ANIN2+ and ANIN2– on the wiring diagram (option).
- AIFB_3 is used to transmit the actual actuator position.
- AIFB_3 is used to transmit the actual actuator torque (option).

There are to Analog Input Transducer Blocks (AITB), both each connected to two Analog Input Function Blocks (AIFB).

Feedback signals via the discrete input function blocks

The AUMATIC is equipped with 3 discrete input function blocks:
Each Discrete Input Function Block (DIFB_1, DIFB_2 and DIFB_3) has its own Discrete Input Transducer Block (DITB_1, DITB_2, DITB_3).
Each function block may transmit up to 8 configurable binary signals. Configuration of these binary signals is defined in the associated Discrete Input Transducer Blocks (DITB_x).

3.2.3 Function block parameter setting

The following steps should be performed in the indicated order to configure a basic function block application. Some parameter settings may depend on the type of application or the control system.

Uniform parameters for all blocks

All blocks contain six general parameters. This includes: ST_REV, TAG_DESC, STRATEGY, ALERT_KEY, MODE_BLK and BLOCK_ERR:

ST_REV Revision status of the static data associated with the function block. For better tracking of changes within the static parameter, the ST_REV of the associated blocks is incremented by one as soon as a status parameter attribute is changed. The ST_REV of the block is also incremented by one if a static parameter attribute is written, however the value itself remains unchanged. The value is reset to 0 as soon as a restart is performed using the default values.

TAG_DESC This parameter can be used for describing the appropriate block application. The value is reset to 32 blanks as soon as a restart is performed using the default values. This data type does not allow zeros.

STRATEGY The strategy field can be used to identify a group of blocks. The data is not checked or processed by the block but used by the higher level system to classify the function blocks.

ALERT_KEY ID number of the plant unit. A common ALERT_KEY can assigned to all devices within a circuit or a plant segment to help the user to classify faults. Each block has its own ALERT_KEY transmitted with every block-specific alarm signal.
The control system can use this information to sort alarm signals, e.g. as code for identifying and classifying the source of the alarm signal. If the ALERT_KEY is not used, occurring fault signals cannot be sent to a certain user console. The ALERT-KEY defines the destination of the alarm signal transfer of this block (to which user console).
The use of this parameter is absolutely recommended!

MODE_BLK This parameter includes the current, intended, permissible, and normal block operation modes.

- TARGET: changes the block operation mode
- ACTUAL: indicates the current block operation mode
- PERMITTED: indicates the permissible operation modes
- NORMAL: indicates the normal block operation mode

Refer to appendix E: Block operation modes (contains detailed information about possible function block states)

BLOCK_ ERR This parameter reflects the fault state of hardware and software components associated with a block. The parameter is a bit string, therefore several errors can be displayed simultaneously.

Resource block (RESOURCE)

The resource block stores device hardware information related to all function blocks within a device (such as e.g. memory size) and controls the device hardware as well as the internal function blocks. Furthermore, it contains the device name, manufacturer, and serial number. Regardless of the execution schedule of the function blocks, the resource block is called up at certain intervals

Commissioning:

1. Lock/unlock write protection:
   Parameter: WRITE_LOCK:
   – Locked = Write protection activated
     (no writing access possible to any changeable parameters)
   – Not Locked = Write protection deactivated (default value on delivery)
2. Enter or change block name (if required):
   Factory setting = RESOURCE- - - - - - - -AC01-works number
3. Set operation mode in MODE_BLK parameter group (TARGET parameter) to OOS (Out_Of_Service).
   Now, the RESOURCE parameters can be configured or changed (if required).
4. Set operation mode in MODE_BLK parameter group (TARGET parameter) to AUTO.
   As the resource block contains the general operation mode of a Foundation Fieldbus device, the MODE_BLK parameter must be set to AUTO to allow the operation of any other function blocks within the AUMATIC.

Transducer block (APVB)

Transducer blocks decouple function blocks from the local input/output functions.
The APVB transducer block of the AUMATIC contains all device-specific parameters to adapt the AUMATIC to the process requirements, as well as data of the electronic name plate as well as the operation data for plant administration and preventive maintenance.

Commissioning:

1. Enter or change block name (if required):
   Factory setting = APVB- - - - - - - - - - -AC01-works number
2. Set operation mode in MODE_BLK parameter group (TARGET parameter) to OOS (Out_Of_Service).
3. Configure parameters for desired actuator behaviour, examples:
   – Type of seating in the end positions
   – Monitoring or tripping torque (Non-Intrusive actuators only)
   – Positioner
   – Operation mode EMERGENCY
   – Monitoring functions
   – Stepping mode
   – Intermediate positions
   For available parameters, refer to the APVB list in appendix B.
4. Set operation mode in MODE_BLK parameter group (TARGET parameter) to AUTO.

Furthermore, the APVB uses the FINAL_POSITION_VALUE parameter to supply status feedback signals about any possible actuator problems to the upstream function blocks of the AUMATIC (DOFB or AOFB), which will then change the operation mode, depending on the situation.

The following status feedback signals are possible:
- Good_NonCascade/NonSpecific
- Good_Cascade/LocalOverride
- Bad/DeviceFailure

Appendix D: Error codes describe the associated parameter error codes, XD_ERROR and XD_ERROR_TXT, as well their causes and possible corrective actions.

Should the reason for the error no longer exist, certain errors can be reset either:
- On the local controls using the **Reset** push button (in selector switch position LOCAL), or
- Via the APPLICATION_RESET parameter of the APVB (index 784):
  APPLICATION_RESET = Uninitialised (0x00): No reset
  APPLICATION_RESET = DO application reset (0x01): Prompt reset

Analog Output Function Block (AOFB)

The AOFB contains the setpoint signal of an upstream block and passes it on to the actuator via the transducer block. The main functions of the AOFB function blocks comprise:
- Scaling
- Setpoint limiters – for both the value and change rate
- Simulation
- Valve position feedback
- Actions upon deviations of upstream block

The AOFB is assigned to a fixed and predefined CHANNEL.

Table 6

Function block	Transducer block	Channel
AOFB	APVB	0x0001

The channel assignment cannot be changed.
The AOFB performs a bi-directional signal processing: Transfer of the valve setpoint to the transducer block (forward path, main function), and feedback of valve position signal from the transducer block to the upstream block (backward path, secondary function).

Rival operation commands are not permitted. Therefore, either the AOFB for setpoint operation commands or the DOFB for OPEN - STOP - CLOSE operation commands, or even the discrete intermediate position commands must be used. Both function blocks may not be active within the AUMATIC at the same time. The use depends on the desired application.

Commissioning:
1. Enter or change block name (if required):
   Factory setting = AOVB- - - - - - - - - - -AC01-works number
2. Set operation mode in MODE_BLK parameter group (TARGET parameter) to OOS (Out_Of_Service).
3. It is recommended to activate the following options for the IO_OPTS parameter:
   – SP-PV Track in Man
   – SP-PV Track in LO
   – SP Track retained target (SP tracks RCas or Cas if LO or Man)
   Refer to appendix E: IO_OPTS, availability and description.

Information A torque fault causes the AOFB to enter operation mode IMan. To solve this torque fault by issuing a AOFB counter command, ‘SP Track retained Target’ must be set; otherwise, the actuator may only be operated into the opposite position using the operation commands of the local controls.

If the current torque is lower than the preset torque, the torque fault can be reset, either

- On the local controls using the **Reset** push button (in selector switch position LOCAL), or
- Via the APPLICATION_RESET parameter of the APVB (Index 784):
  APPLICATION_RESET = Uninitialised (0x00): No reset
  APPLICATION_RESET = DO application reset (0x01): Prompt reset

4. Further AOFB parameters can now be configured or changed (if required).
5. The option 'NormalShed_NormalReturn' should be activated in the SHED_OPT parameter.
6. Set operation mode in MODE_BLK parameter group (TARGET parameter) to CASCADE.

Discrete Output Function Block (DOFB)

The DOFB contains the operation command signal of an upstream block and passes it on to the actuator via the transducer block. The main functions of the DOFB function blocks comprise:

- Simulation
- Actions upon deviations of upstream block
- Signal inversion

The DOFB is assigned to a fixed and predefined CHANNEL.

Table 7

Function block	Transducer block	Channel
DOFB	APVB	0x0002

The channel assignment may not be changed.
Rival operation commands are not permitted. Therefore, either the AOFB for setpoint operation commands or the DOFB for OPEN - STOP - CLOSE operation commands, or the discrete intermediate position commands must be used. Both function blocks may not be active within the AUMATIC at the same time. The use depends on the desired application.

Commissioning:

1. Enter or change block name (if required):
   Factory setting = DOVB- - - - - - - - - - -AC01-works number
2. Set operation mode in MODE_BLK parameter group (TARGET parameter) to OOS (Out_Of_Service).
3. It is recommended to activate the following options for the IO_OPTS parameter:
   – SP-PV Track in Man
   – SP-PV Track in LO
   – SP Track retained target (SP tracks RCas or Cas if LO or Man)
   Refer to appendix E: IO_OPTS, availability and description. Information

Information

A torque fault causes the DOFB to enter operation mode IMan. To solve this torque fault by issuing a DOFB counter command, 'SP Track retained Target' must be set; Otherwise, the actuator may only be operated into the opposite position using the operation commands of the local controls.
If the current torque is lower than the preset torque, the torque fault can be reset, either

- On the local controls using the **Reset** push button (in selector switch position LOCAL), or
- Via the APPLICATION_RESET parameter of the APVB (Index 784):
  APPLICATION_RESET = Uninitialised (0x00): no reset
  APPLICATION_RESET = DO application reset (0x01): prompt reset

4. Further DOFB parameters can now be configured or changed (if required).
5. The option 'NormalShed_NormalReturn' should be activated in the SHED_OPT parameter.
6. Set operation mode in MODE_BLK parameter group (TARGET parameter) to CASCADE.

Analog Input Function Blocks (AIFB)

The AUMATIC is equipped with 4 analog input function blocks:
The main functions of the AIFB comprise:

- Signal inversion (I/O processing option)
- Simulation
- Filtering (time delay)
- Signal testing and alarm generation
- Scaling

Each AIFB is assigned to a fixed and predefined CHANNEL and the pertaining analogue value:

Table 8

Function block	Transducer block	CHANNEL	Analogue value
AIFB_1	AITB_1	0x0003	External input No. 1; input signal 0 – 20 mA = 0 – 100 %
AIFB_2	AITB_1	0x0004	External input No. 2; input signal 0 – 20 mA = 0 – 100 %
AIFB_3	AITB_2	0x0005	Actual position E2, 0 – 100 %
AIFB_4	AITB_2	0x0006	Current torque, 0 – 100 %; 0 – 50 % corresponds to: torque in direction CLOSE (0 % = nominal torque CLOSED reached) 50 – 100 % corresponds to: torque in direction OPEN (100 % = nominal torque OPEN reached) 50 % = current torque = 0 Nm

Information An AIFB is assigned to each channel. The CHANNEL assignment may not be changed!

Commissioning using the analog input function blocks:

1. Enter or change block name (if required):
   Factory setting = AIVB_x- - - - - - - - - - - -AC01-works number
2. Set operation mode in MODE_BLK parameter group (TARGET parameter) to OOS (Out_Of_Service).
3. Check CHANNEL parameter. Make sure that the value corresponds to the desired analogue value, use a different AIFB, if required.
4. Use L_TYPE parameter to select the linearisation type for the input value (Direct, Indirect, Indirect Sq Root), recommendation: Direct

Information For ‘DIRECT’ linearisation type, the configuration of the OUT_SCALE parameter group has to match with the configuration of the XD_SCALE parameter group. Otherwise the block operation mode cannot be set to AUTO. An incorrect configuration is indicated via the BLOCK_ERROR parameter (‘Block Configuration Error’).

5. The following parameters can be used to define limit values for alarm and warning signals (if required).
   The limit values entered must be within the value range specified in the OUT_SCALE parameter group.

Table 9

HI_HI_LIM	Limit value for the upper alarm
HI_LIM	Limit value for the upper warning
LO_LIM	Limit value for the lower warning
LO_LO_LIM	Limit value for the lower alarm

6. Define signal priorities when exceeding or falling below the specified limit values (HI_HI_PRI, HI_PRI. LO_PRI and LO_LO_PRI parameters).
7. Set operation mode in MODE_BLK parameter group (TARGET parameter) to AUTO.
8. Set operation mode of the associated transducer block (ATIB_x) in MODE_BLK parameter group (TARGET parameter) to AUTO.

Discrete Input Function Blocks (DIFB)

The AUMATIC has 3 DIFBs; each can transmit up to 8 different binary input signals via Foundation Fieldbus.
Main function of a DIFB:

- Signal inversion
- Simulation
- Filtering (time delay)
- Alarm generation
-

The DIFB is assigned to a fixed and predefined CHANNEL.

Table 10

Function block	Transducer block	Channel
DIFB_1	DITB_1	0x0007
DIFB_2	DITB_2	0x0008
DIFB_3	DITB_3	0x0009

The channel assignment may not be changed.

The configuration of these discrete signals is to be defined in the associated Discrete Input Transducer Blocks (DITB_x) using DI_SOURCE_BIT_x parameters (refer to table):

Table 11

Parameter: DI_SOURCE_BIT_x

Signal designation in the configuration software	Value	Description
Uninitialised	0 (0x00)	Not used (factory setting)
Running CLOSE	1 (0x01)	Operation command (CLOSE or SETPOINT) performed by Foundation Fieldbus or local controls in direction CLOSE. For operation in stepping mode, this signal is also active during an off-time, also during dead time or the reversing prevention.
Running open	2 (0x02)	Operation command (OPEN or SETPOINT) performed by Foundation Fieldbus or local controls in direction OPEN. For operation in stepping mode, this signal is also active during an off-time, also during dead time or the reversing prevention.
CLOSED position	3 (0x03)	For limit seating in end position CLOSED: Limit switch active in direction CLOSE. For torque seating in end position CLOSED: Torque switch and limit switch active in direction CLOSE.
OPEN position	4 (0x04)	For limit seating in end position OPEN: Limit switch active in direction OPEN. For torque seating in end position OPEN: Torque switch and limit switch active in direction OPEN.
TSC (DSR)	5 (0x05)	Torque switch clockwise closing active (storing).
TSO (DOEL)	6 (0x06)	Torque switch counterclockwise opening active (storing).
LSC (WSR)	7 (0x07)	Limit switch clockwise closing active.
LSO (WOEL)	8 (0x08)	Limit switch counterclockwise opening active.
LOCAL switch position	9 (0x09)	Selector switch in position LOCAL.
REMOTE switch position	10 (0x0A)	Selector switch in position REMOTE.
Loss of phase	11 (0x0B)	One phase missing; Remedy: Connect phase. When externally supplied with 24 V DC, the complete AC power supply might be missing; check and connect, if necessary.
Thermo fault	12 (0x0C)	A thermal fault (motor protection) has occurred. Remedy: Cool down, wait or perform “Reset” after cool-down. Check fuse F4.
Intermediate position 1	13 (0x0D)	Intermediate position 1 reached.
Intermediate position 2	14 (0x0E)	Intermediate position 2 reached.

Parameter: DI_SOURCE_BIT_x		
Signal designation in the configuration software	**Value**	**Description**
Intermediate position 3	15 (0x0F)	Intermediate position 3 reached.
Intermediate position 4	16 (0x10)	Intermediate position 4 reached.
Intermediate position 5	17 (0x11)	Intermediate position 5 reached.
Intermediate position 6	18 (0x12)	Intermediate position 6 reached.
Intermediate position 7	19 (0x13)	Intermediate position 7 reached.
Intermediate position 8	20 (0x14)	Intermediate position 8 reached.
FF digital input 1	21 (0x15)	A 24 V signal is present at the digital input 1.
FF digital input 2	22 (0x16)	A 24 V signal is present at the digital input 2.

Commissioning using the discrete input function blocks:

1. Enter or change block name (if required):
   Factory setting = DIFB- - - - - - - - - - - -AC01-works number
2. Set operation mode in MODE_BLK parameter group (TARGET parameter) to OOS (Out_Of_Service).
3. Now, the DIFB parameters can be configured or changed, if required.
4. Set operation mode in MODE_BLK parameter group (TARGET parameter) to AUTO.
5. Set operation mode of the associated transducer block (DITB_x) in MODE_BLK parameter group to OOS.
6. Configure DI_SOURCE_BIT_x parameter of the associated Discrete Input Transducer Block (DITB_x) in accordance with the desired feedback.
7. Set operation mode of the associated transducer block (DITB_x) in MODE_BLK parameter group (TARGET parameter) to AUTO.

Table 12	
Discrete input function block	**Associated transducer block**
DIFB_1	DITB_1
DIFB_2	DITB_2
DIFB_3	DITB_3

PID function block (PID)

The PID function block receives an input signal, performs the PID control computation and issues an output signal. In practice, it performs PID computation based on the deviation between the process setpoint and the process actual value and generates a value at the OUT output to decrease the calculated deviation. The PID block works together with other function blocks, such as the AI and AO blocks.

Main functions of the PID:

- Filtering
- Setpoint limiters – for both the value and change rate
- Scaling Process Variables (PV), setpoint (SP), and output (OUT)
- PID control computation
- Control action bypass
- Feed-forward
- External output tracking
- Measured value tracking
- Output limiters
- Mode change in case of faults and alarm signals

Algorithm

The PID block uses an algorithm for PID control; the calculation principle is shown below. The process control is possible by taking proportional, integral, and derivative counter-measures in response to characteristic changes of the control process, load changes, and the occurrence of faults.

Principle of PID algorithm:

Figure 9

$$\Delta MV_n = K\left\{(SP_n - PV_n) + \frac{\Delta T}{Ti}(SP_n - PV_n) + \frac{Td}{\Delta T}\left[(SP_n - PV_n) - (SP_{n-1} - PV_{n-1})\right]\right\}$$

MVn	Change at control output	K	Proportional gain (= GAIN)
PVn	Process variable	Ti	Reset time (=RESET)
SPn	Process setpoint	Td	Derivative time (=RATE)
ΔT	Control time (execution time in block header)		

The output value is calculated based on control output changes:
OUT = BKCAL_IN – MVn

PID control parameters

The table below shows the PID control parameters:

Table 13

Parameter	Description	Valid range
GAIN	Proportional gain Kp	0.05 to 20
RESET	Reset time Tn	0.1 to 10,000 (seconds)
RATE	Derivative time Tv	0 to ∞

In case of an error variable, the P portion (GAIN) immediately (i.e. actively) changes the position value (proportionally to the error variable).
If even a small error variable is supposed to generate a major valve position change, the proportional gain Kp must be set to a high value.
The reset time (RESET) determines the I portion of the controller. The more inert a system, the higher this value should be set.
The rate time (RATE) determines the D portion of the controller. Typically, no setting is required here (= 0), since actuator and valve – due to the operating time – cannot react abruptly to a sudden occurrence of an error variable.

Commissioning when using the PID:

1. Enter or change block name (if required):
   Factory setting = PIDFB- - - - - - - - - -AC01-works number
2. Set operation mode in MODE_BLK parameter group (TARGET parameter) to OOS (Out_Of_Service).
3. Set BYPASS parameter (index 367) to Off.
4. Now, the PID parameters can be configured or changed, if required.

Procedure for process controller setting

The setting of the process controller largely depends on the application environment for the controller. A PI controller suffices for most applications.

4.1 Operate the controller as P controller first, i.e. set the parameters as follows:
- GAIN (proportional gain Kp) = 1
- RESET (reset time Tn) = 1000 s
- RATE (rate time Tv) = 0

4.2 Double GAIN until the control loop starts to oscillate.
4.3 Reduce GAIN to 60 % of the set value.
4.4 Decrease RESET until the error variable equals zero.

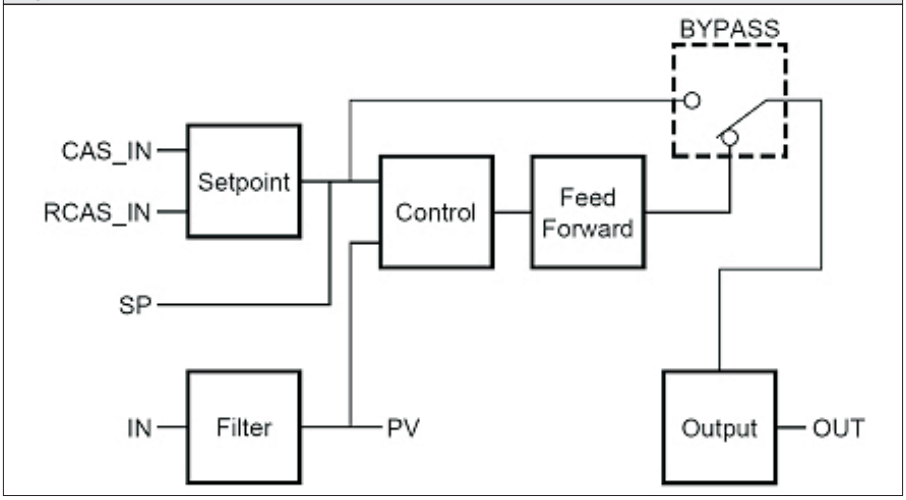
5. The direction of the control action can be defined by activating Direct Acting within the CONTROL_OPTS parameter.

Table 14

Direct Acting	Description
True	The output value increases, if the input process variable exceeds setpoint SP.
False	The output value decreases, if the input process variable exceeds setpoint SP.

6. If required, bypass PID computation.
   Bypass PID computation = activate Bypass_Enable option via CONTROL_OPTS parameter (directly connect SP to output OUT).
   Activate PID computation = deactivate Bypass_Enable.

Figure 10



7. Further settings can be performed using the CONTROL_OPTS and the STATUS_OPTS parameters.
8. The option 'NormalShed_NormalReturn' should be activated in the SHED_OPT parameter.
9. Set operation mode in MODE_BLK parameter group (TARGET parameter) to AUTO.

3.3. Network configuration

This clause contains information to adapt the AUMATIC to the fieldbus network requirements

3.3.1 Tag and device address

Before connecting devices with Foundation Fieldbus, PD Tag (Physical Device Tag) and device addresses must be assigned.
The PD tag is an identifier used for the device. Up to 32 alpha-numerical characters can be used for data entry.

Address ranges

The device address is used to identify devices during communication. The valid address range is between 16 and 247 ($0x10_{hex}$ and $0xF7_{hex}$). Link master devices receive lower addresses, basic devices higher addresses. An appropriate address range is available for each of these device types.

The AUMATIC can be placed in both ranges: Within the range for basic devices or for link master devices.
The factory setting for the AUMATIC is address 27 ($0x1B_{hex}$) and the device is configured as link master device. If the AUMATIC has to be operated as basic device, the MIB parameter BOOT_OPERAT_FUNCTIONAL_CLASS has to be changed from 0x00 (LM) to 0x01 (BASIC). After this the AUMATIC has to be restarted.

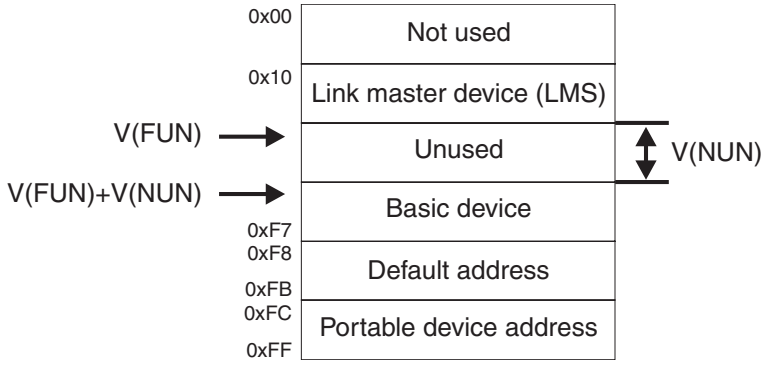
Information The device with the lowest address within the link master devices range adopts the LAS function.

The following parameters for address range setting should be adapted:

Table 15

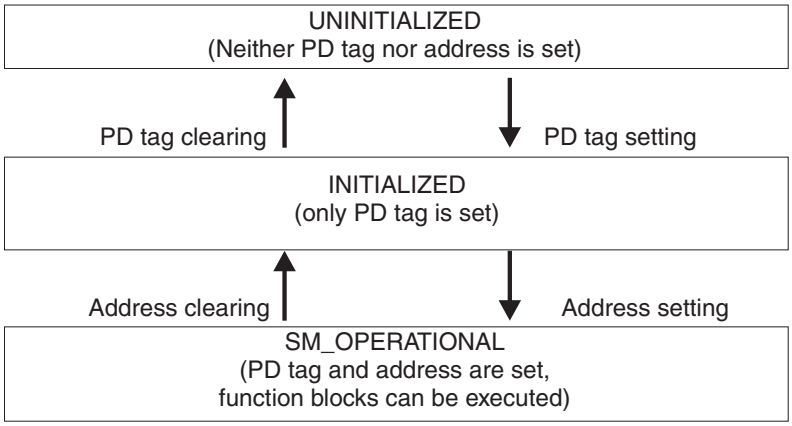
Parameter	Description
V(FUN)	First unpolled node; the highest address which can be assigned to a link master device is V(FUN) – 1.
V(NUN)	Number of unpolled nodes; here, the gap of unused consecutive addresses is defined. The first address which can be assigned to Basic Devices is V(VUN) + V(NUN).

Devices within the ‘Unused’ address range are excluded from communicating via Foundation Fieldbus, because the LAS does not periodically check this range for new devices. V(FUN) and V(NUN) parameters have to be adapted according to the addresses assigned within the Foundation Fieldbus network, the unused range should be selected in a way to ensure that the LAS does not unnecessarily poll the addresses of devices, not being connected.



Tag and device address setting

A Foundation Fieldbus Device can take on three states. If the state does not correspond to the SM_OPERATIONAL state, no function block will be executed.



AUMATIC default setting:
PD Tag AUMATIC- - - - - - - -AC01-works number
Address 27 (or $0x1B_{hex}$).

If two AUMATIC actuator controls are connected to the same address within the same Foundation Fieldbus network, one of the controls keeps the address assigned, whereas the other device uses a default address (from 248 [or $0xF8_{hex}$] to 251 [or $0xFB_{hex}$]).

Change the device address:
1. Delete the address (CLEAR_ADDRESS).
2. Assign new, unused address (SET_ADDRESS).

Change the PD tag:
1. Delete address and PD tag.
2. Then, assign again PD tag and address.

Devices for which the address has been deleted will wait within the default address range for a new setting (randomly chosen from a range of 248 (or $0xF8_{hex}$) to 251 (or $0xFB_{hex}$). At the same time, the device ID must be known to clearly identify the device. The worldwide unique device ID for the AUMATIC is 0A01FF01F8-AUMA-AC01-works number.

3.3.2 Link master parameter setting

To ensure stable communication, different parameters must be observed and adapted to the connected link master devices. When setting the parameters in compliance with table 16, the highest value of all devices which are connected to the same Foundation Fieldbus network, must be used.
Link master parameter for the AUMATIC:

Table 16

Symbol	Parameter	Description
V(ST)	Slot Time	Time necessary for an immediate response of the device (unit: ½56 µs). For the AUMATIC, set value ≥ 4.
V(MID)	Minimum Inter PDU Delay	Minimum time between two data telegrams. Unit: ½56 µs. For the AUMATIC, set value ≥ 6.
V(MRD)	Maximum Response Delay	Maximum response time (unit: slot time (V(ST)); V(MRD) x V(ST) must be ≥ 20 for the AUMATIC.

3.3.3 Scheduling parameter setting

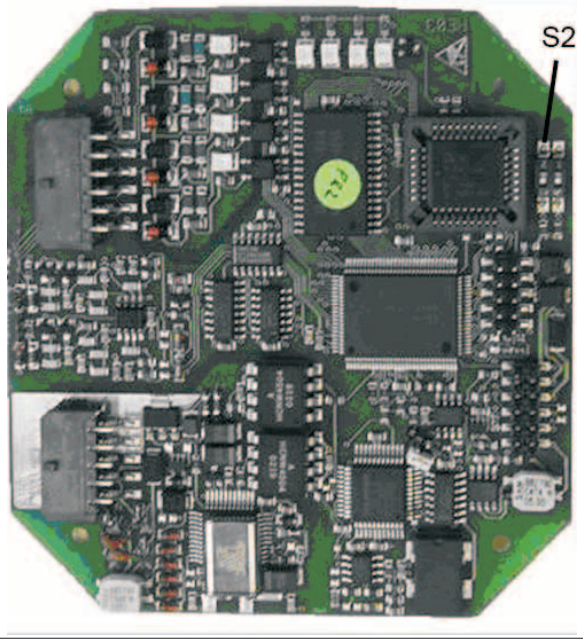
The process application is built by using and combining function blocks. The scheduling of the connected function blocks is precisely defined during configuration of the function block application.
The combined blocks have to be executed simultaneously with other blocks within the communication schedule. Synchronisation is performed via the LAS.
The MACROCYCLE_DURATION parameter is used to define the cycle time of the devices connected to the network.
MACROCYCLE_DURATION specifies the macrocycle duration.
The unit of this parameter is 1/32 ms and the default value for the AUMATIC is 32000 ($0x7D00_{hex}$ = 1 s). This value can be optimised, if required.

4. Additional functions

4.1. Simulation function

This function is very useful for plant commissioning. It is only active if the simulation switch (hardware switch on the FF interface board, see below) is set to ON and, if the simulation function has been set to Active via the ENABLE_DISABLE parameter of the SIMULATE parameter group of the function block.
All input and output function blocks have such a SIMULATE parameter group. The parameters are used as switches or interfaces between the I/O function block and the associated transducer block or hardware channel. For the inputs, the transducer value and status are supplied by the transducer block or the input channel. If the simulation is deactivated, you will receive the data sent to the input block. After simulation activation, the simulated value and associated status are transmitted via the input block. The status value can be used to simulate transducer errors.
For active simulation, the simulated values are returned as READBACK values to the outputs. The transducer values are hereby ignored and the transducer maintains its last output value.

Figure 11



To activate the simulation, S2 must be set to ON.

After setting S2 to ON, the RESOURCE block indicates BLOCK_ERR = SimulationActive; as soon as the simulation function of a function block is activated using the simulation parameter, this block also indicates BLOCK_ERR = SimulationActive.

Information After the simulation, S2 must be reset to OFF and the ENABLE_DISABLE parameter of the SIMULATE parameter group has to be reset to Disabled.

4.2. Fault state function

The fault state function is provided for processes and applications requiring the actuators to close and open, if the upstream block is unavailable, e.g. due to a communication error.

Various fault state parameters determine the response of a Foundation Fieldbus output block (AO or DO), if one of the following conditions exists for longer than the time defined via the FSTATE_TIME parameter:

- Communication loss for CAS_IN (status 'Bad: No Comm'), if the target mode is CAS
- Initiate Fault State (IFS) status of CAS_IN (status 'Good: IFS'), if the target mode is CAS
- Initiate Fault State (IFS) status of RCAS_IN (status 'Good: IFS'), if the target mode is RCAS

If one of these conditions applies, the block activates the defined fault state function.

The following parameters must be considered when using the fault state function:

1. Ensure that the failure behaviour defined in the APVB is switched off; refer to FAILURE_BEHAVIOUR parameter (section 50 APVB parameter; index 803). This parameter must be set to 0x00 (off)!
2. Define the delay time to execute the fault state function of AOFB or DOFB using the FSTATE_TIME parameter.
3. Define the response of AOFB or DOFB output via IO_OPTS parameter:
   – "Fault State to value" (bit 6). If this option is activated, the FSTATE_VAL (or FSTATE_VAL_D) parameter of AOFB (or DOFB) parameter has to be defined additionally in order to determine the output value during active fault state function ("Fail to preset" behaviour). If the "Fault State to value" (bit 6) option is not activated, the output status is frozen when a fault occurs ("Fail as Is" behaviour).
   – "Use Fault State on restart" (bit 7) is used to define if FSTATE_VAL (or FSTATE_VAL_D) is output when starting or restarting the block. If the "Use Fault State on restart" (bit 7) option is not activated, the output value is adapted to the process value when starting or restarting.
4. Activate the fault state function using the FEATURE_SEL, option "Faultstate supported" (bit 2) parameter in the RESOURCE block.

Further parameters to configure the fault state behaviour:

1. RESOURCE block parameters:
   – SET_FSTATE: This parameter allows manual initiation of the fault state function by selecting "Set".
   – CLR_FSTATE: Selecting "Clear" deactivates the fault state function of the device if no fault condition persists.
   – FAULT_STATE: This parameter indicates that the AO/DO output block performs the define fault state action due to the SET_FSTATE parameter setting.
2. If a PID block is used to control the AO function block, the fault state behaviour can be influenced by means of the STATUS_OPTS parameter of the PID block:
   – "IFS if BAD IN", sets the initiate fault state status in the OUT parameter, if the IN parameter status is Bad.
   – "IFS if BAD CAS_IN", sets the initiate fault state status in the OUT parameter, if the CAS_IN parameter status is Bad.
   – The "Use Uncertain as Good" setting treats an Uncertain status of the IN parameter as Good, otherwise as Bad.
   – "Target to Manual if BAD IN", sets the target mode of the PID block to manual if the IN parameter status is Bad.

Information

The quality of a configured cyclical connection (publisher-subscriber connection) between the function blocks is assessed using the stale counter. The blocks receiving data (subscriber) monitor if a valid value is available at the configured time. A value is valid if the reception is made with “Good” state at the expected point in time.
The stale counter defines how many subsequent “Bad” (stale) values can be accepted until the fault state function of the block is activated.
This monitoring is deactivated by setting the stale counter to 0.
During active fault state behaviour, the respective function block changes to Local Override (LO) operation mode.

If the fault state function of the actuator is active, the defined fault state position is approached. If the actuator is then moved to another position (e.g. by manual operation), it will try to maintain the set fault state position action while the selector switch is in position REMOTE.

To prevent a new approach to the fault state position during manual operation, the selector switch of the local controls must be switched to position LOCAL or OFF before operating the handwheel.

If the fault state function is not required, it is recommended to perform the following settings:

1. Deactivate fault state function using the FEATURE_SEL parameter of the resource block (“Fault State supported” (bit 2) must be cleared).
2. The following IO_OPTS parameter settings of the AOFB or DOFB should be activated to ensure that the actuator remains in the current position:
   – “SP-PV Track in MAN”, allows the setpoint to track the process variable if the target mode of the block is Man.
   – “SP-PV Track in LO”, allows the setpoint to track the process variable if the target mode of the block is in Local Override (LO).

These parameter settings can be also used for those applications, requiring the fault state function for flawless transition from Man or Local Override (LO) into Auto or CAS mode.

Information

The fault state function described here exclusively concerns fault responses of the Foundation Fieldbus and the associated function blocks.
Optionally, the AUMATIC can also be controlled via an analogue 4 – 20 mA signal (for combinations of a Foundation Fieldbus interface with a parallel interface or use of additional binary and analogue inputs as operation command inputs). For these cases, the failure operation mode of the AUMATIC must be used (refer to manual “Operation and setting” of the AUMATIC or the APVB parameters of the failure operation mode, index 803 to 807). Ideally, an identical actuator behaviour is configured for the fault state function and the failure operation mode.

4.3. Enable local controls function (option)

The ENABLE_LOCAL_CONTROLS parameter of the APVB transducer block (Index 785) is used to enable or disable the selector switch function of the local controls.

This setting is only available if the AUMATIC parameter `ENABLE LOCAL MODE (M410W)` is set to `FF-INTERFACE`.

1. Enable operation in selector switch position REMOTE:

→ ENABLE_LOCAL_CONTROLS = Enable Operation in REMOTE position (= 0x01).

2. Enable operation in selector switch position OFF:

→ ENABLE_LOCAL_CONTROLS = Enable Operation in OFF position (= 0x02).

3. Enable operation in selector switch position LOCAL:

→ ENABLE_LOCAL_CONTROLS = Enable Operation in LOCAL position (= 0x04).

These three release function may also be combined:

4. Enable operation in all selector switch positions:

→ ENABLE_LOCAL_CONTROLS =
Enable Operation in REMOTE position +
Enable Operation in OFF position +
Enable Operation in LOCAL position (= 0x07).

The following fault signals are emitted if one out of the three selector switch positions is not enabled while the Foundation Fieldbus communication is active.

- Status indication S0: RESTRICTED.
- The Foundation Fieldbus APVB transducer block signals a fault via XD_ERROR (General Error, 17 (0x11) and XD_ERROR_EXT (Not ready Indication, 0x00000010), thus generating an operation mode change of the DOFB or AOFB to the IMan status.

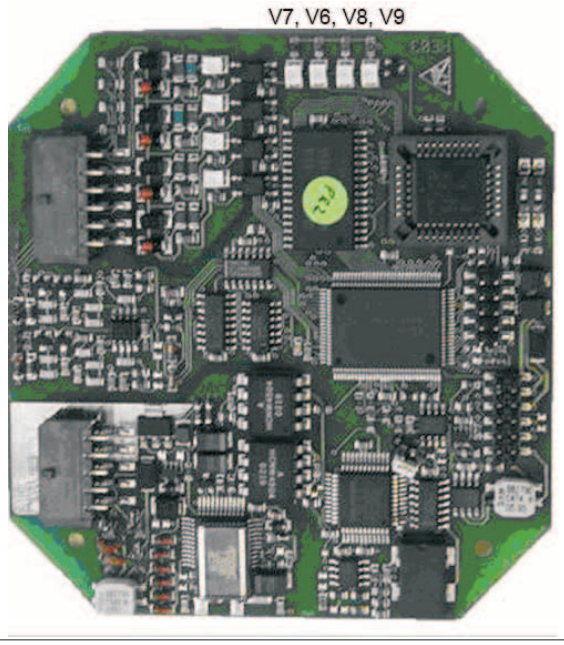
If the communication via Foundation Fieldbus is not available, all three selector switch positions are enabled.

Information In normal operation status and when using the enable local controls function, the selector switch position REMOTE should always be enabled (ENABLE_LOCAL_CONTROLS = Enable Operation in REMOTE position).

5. Foundation Fieldbus board description

Foundation Fieldbus interface:

Figure 12



V9 LED SYSTEM OK (green)
V8 LED DATA EX (green)
V6 LED CAN STATE
V7 LED STATE

5.1. Displays (optical signals)

V9: LED STATE (green)

Is illuminated or not illuminated: Foundation Fieldbus board not ready
Is blinking: Program on the Foundation Fieldbus interface is being executed.

Regular single blinking of the LED during operation indicates correct function of the Foundation Fieldbus board.

V8: LED CAN STATE (red)

Is illuminated or blinking: Communication to logic is faulty
Is not illuminated: Communication with logic is in order

V6: LED BUS ACTIVE (green)

If the LED is illuminated, the AUMATIC is receiving Foundation Fieldbus telegrams from another Foundation Fieldbus device.

V7: LED SYSTEM OK (green)

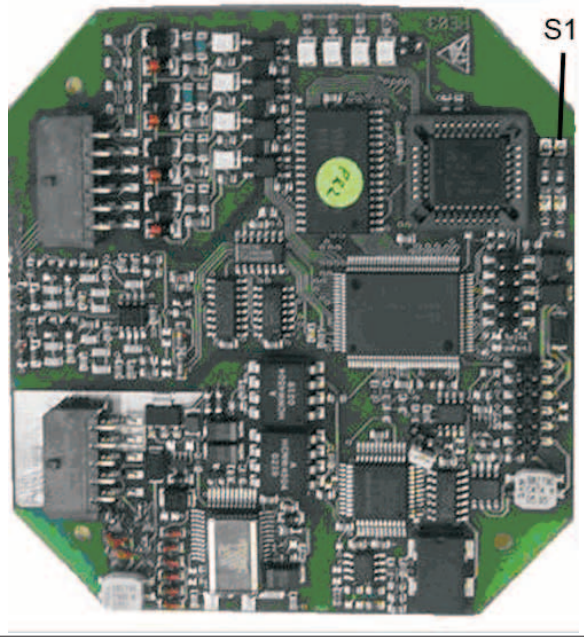
Shows the correct internal voltage supply to the Foundation Fieldbus board.

Is continuously illuminated: The voltage is connected to the Foundation Fieldbus board.
Is blinking: Microcontroller defective.
Is not illuminated: No power supply available at the Foundation Fieldbus interface.

5.2. Factory setting

Foundation Fieldbus interface:

Figure 13



All settings, parameters, and configurations for the Foundation Fieldbus interface can be reset to the factory setting.

1. Push dip switch S1 to ON.
2. Switch AUMATIC off and on.
3. Push dip switch S1 to OFF.

Information After the resetting to factory setting, all settings of the Foundation Fieldbus interface previously made must be performed again.

6. Corrective action

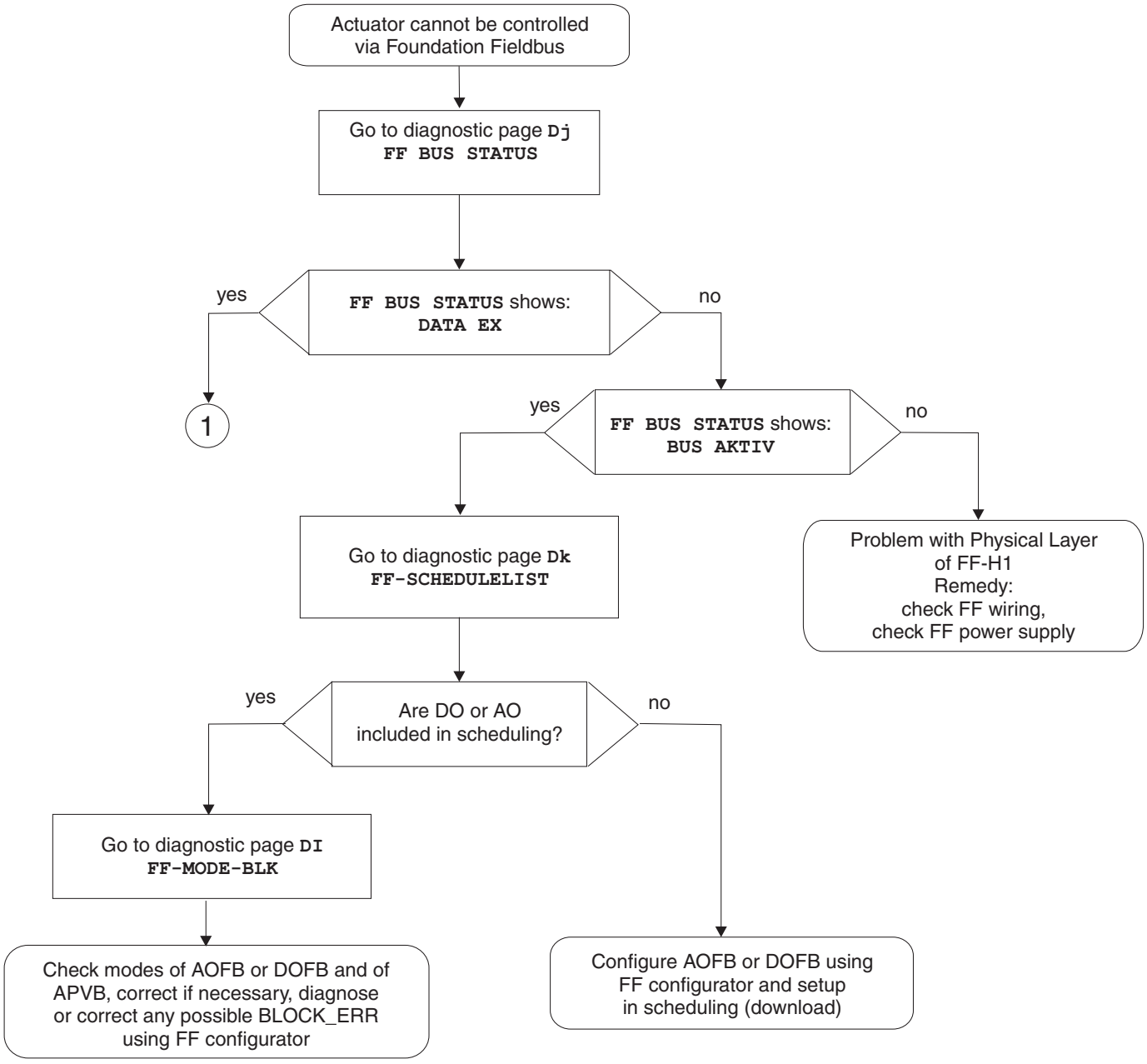
6.1. Fault indications and warning indications

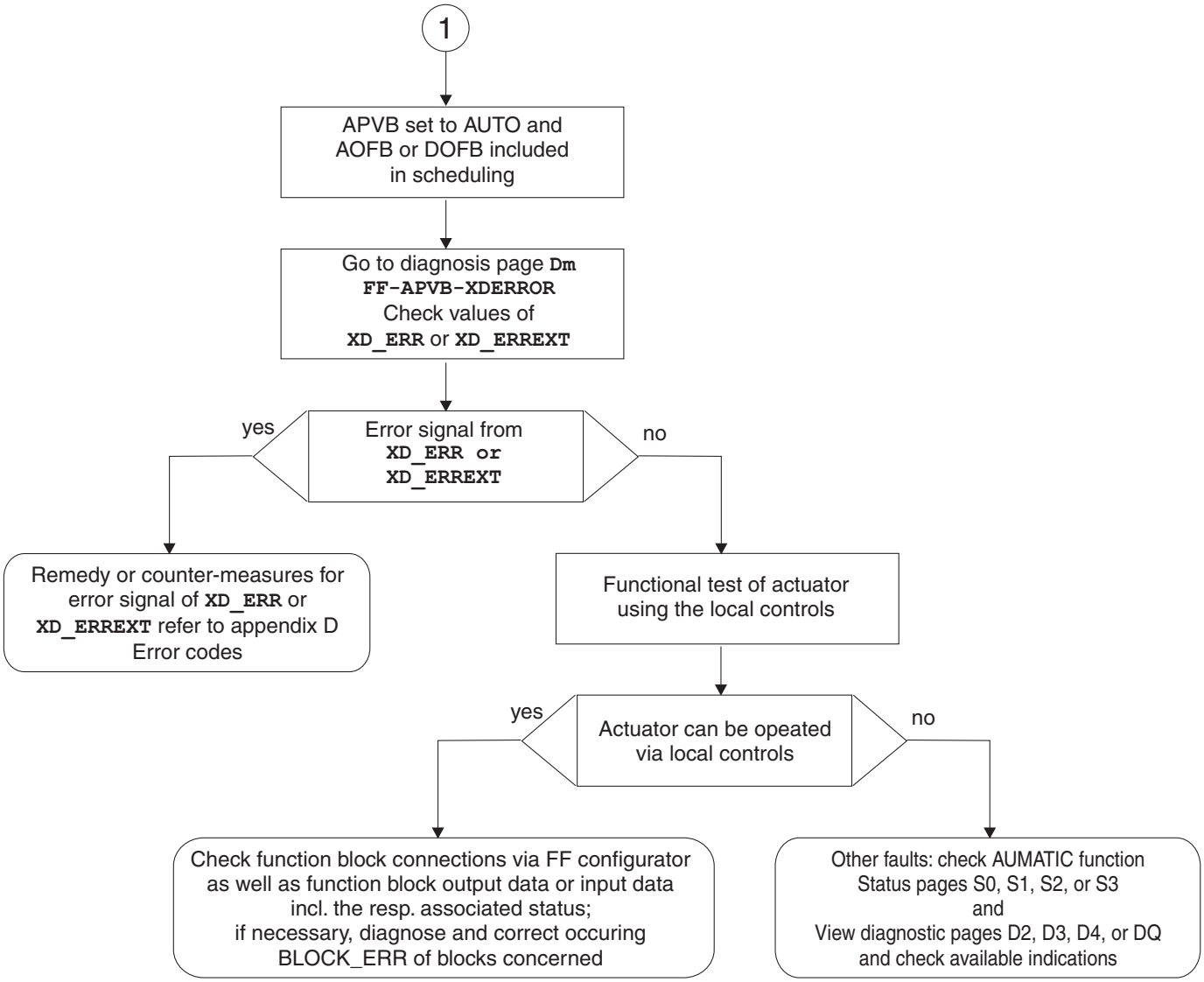
Faults interrupt or prevent the electrical actuator operation.
Warnings have no influence on the electrical actuator operation. They only serve for information purposes. Fault and warning indications are shown on the display (status indications S).

6.2. Diagnostics

The information contained in the diagnostic indications is only provided for the AUMA service and for enquiries in the factory.
The diagnostic indications can be called up during trouble-shooting via the display (group D).

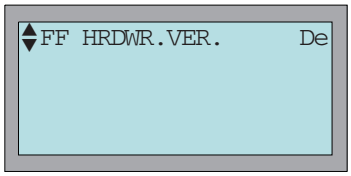
6.3. Troubleshooting




1
APVB set to AUTO and AOFB or DOFB included in scheduling
Go to diagnosis page Dm FF-APVB-XDERROR Check values of XD_ERR or XD_ERREXT
yes
Error signal from XD_ERR or XD_ERREXT
no
Remedy or counter-measures for error signal of XD_ERR or XD_ERREXT refer to appendix D Error codes
Functional test of actuator using the local controls
yes
Actuator can be opeated via local controls
no
Check function block connections via FF configurator as well as function block output data or input data incl. the resp. associated status; if necessary, diagnose and correct occuring BLOCK_ERR of blocks concerned
Other faults: check AUMATIC function Status pages S0, S1, S2, or S3 and View diagnostic pages D2, D3, D4, or DQ and check available indications

6.4. FF diagnostic indications (D) via the display

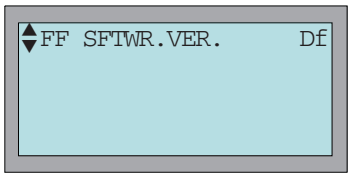
FF hardware version (De)



Description of the display:

FF HRDWR.VER.
Hardware version of the Foundation Fieldbus interface

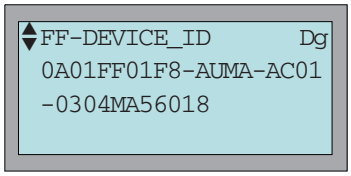
FF software version (Df)



Description of the display:

FF SFTWR.VER.
Software version of the Foundation Fieldbus interface

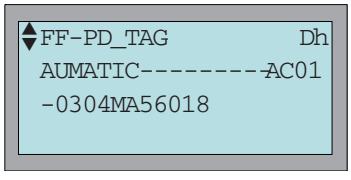
FF device ID (Dg)



Description of the displays:

FF-DEVICE_ID
The device ID is a worldwide unambiguous device identification. It serves the purpose of recognising a Foundation Fieldbus device by means of the fieldbus and, therefore, cannot be modified. The device ID comprises 32 characters and consists of the manufacturer ID (0x0A01FF), the device type (0x01F8), the text -AUMA-AC01-, as well as the AUMATIC works number.

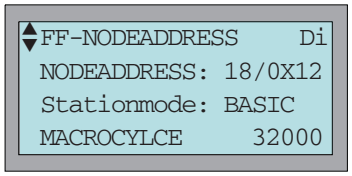
FF PD tag (Dh)



Description of the display:

FF-PD_TAG
The PD Tag (Physical Device Tag) is the physical device name. The PD Tag comprises 32 characters and consists of the text AUMATIC- - - - - - - - -AC01- and the works number as default, when leaving the factory. The PD Tag serves the purpose of device identification within a plant and, therefore, the user may adapt the identification via Foundation Fieldbus as required.

FF node address (Di)



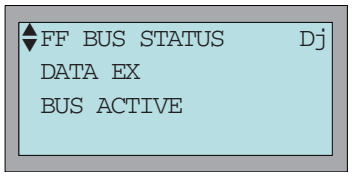
Description of the display:

NODEADDRESS
The current device address as decimal and hexadecimal value.

Stationmode
: BASIC, when configurating the AUMATIC as Basic Device.
: LM, when configurating the AUMATIC as Link Master Device.
: LAS, if the AUMATIC has been configured as Link Master device and is working as LAS (Link Active Scheduler).

MACROCYCLE
The preset macro cycle of the Foundation Fieldbus (unit 1/32 ms).

FF bus status (Dj)

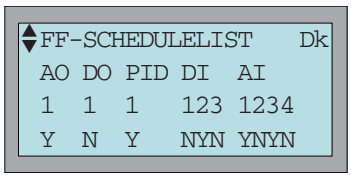


Description of the displays:

DATA EX
Indicates active actuator controls via the Foundation Fieldbus interface; for this, the APVB transducer block must be activated in AUTO and the DOFB or AOFB within the AUMATIC must be included in the FF scheduling. Thus, DATA EX signals an operable local Foundation Fieldbus application within the AUMATIC.

BUS ACTIVE
Indicates, that besides the AUMATIC, further Foundation Fieldbus devices are connected to the same bus. This indicates correct wiring.
To ensure perfect function in combination with other devices, both DATA EX and BUS ACTIVE must be set.

FF schedule list Dk

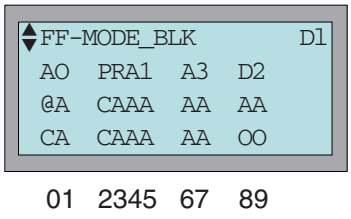


Description of the displays:

FF-SCHEDULELIST

The FF schedule list comprises the AUMATIC function blocks which can be called up within the AUMATIC due to a function block application configured by the user and loaded into the AUMATIC.
The transducer blocks pertaining to the function blocks are not shown, as they are directly called up by the used function blocks; the same is valid for the resource block not being shown, as it will be automatically called up within the AUMATIC.
The character below the function block number indicates, whether the respective function block is being called up within the AUMATIC or included in the FF Scheduling (“Y”) or not (“N”).

FF mode block Dl



01 2345 67 89

0	AOFB	5	AITB1
1	APVB	6	AIFB3
2	PID	7	AITB3
3	RESOURCE	8	DIFB2
4	AIFB1	9	DITB2

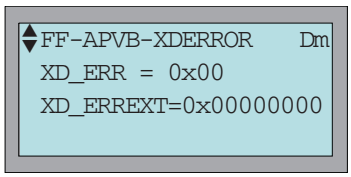
Description of the displays:

This display shows the target and actual operation modes of all function blocks called up within the AUMATIC. The pertaining transducer block is shown with each function block (exceptions: resource block and PID function block).
Only those function blocks are shown being called up in the AUMATIC.
The following identifications are used for the target and actual operation modes of the function blocks:

r	ROut	Remote Output
R	RCas	Remote Cascade
C	Cas	Cascade
A	Auto	Automatic
M	Man	Manual
L	LO	Local Override
I	IMan	Initialisation Manual
O	OOS	Out of Service
@	Auto+Cas	Automatic and Cascade

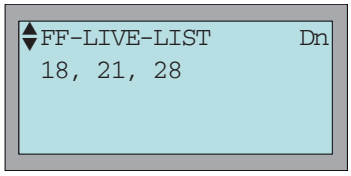
Thus way, the states of all function blocks can be shown on one display page.

FF APVB-XD error Dm



Description of the displays:
Actuator problems or fault signals are signalled back to the function blocks via the transducer blocks. The faults occurred are shown in the transducer blocks by means of the variables XD-ERROR and XD-ERROR_EXTENDED. The most important actuator fault signals are combined via the APVB and transferred to the DOFB or AOFB, which will in turn take on a safe operation status. The contents of these two variables are shown on the FF-APVB-XDERROR diagnostic page. For further references regarding the interpretation of the error codes shown, please refer to the “Manual (Device integration Fieldbus) AUMATIC AC 01.1/ACExC 01.1 Foundation Fieldbus". Any existing error is simultaneously shown via the hitherto existing status and diagnostic displays of the AUMATIC.

FF live list Dn



Description of the displays:
This diagnostic displays lists the first 15 device addresses comprised within the Foundation Fieldbus system. The comma after the last displayed device address indicates that further participants are available.
It is only possible to dress the live list, if the AUMATIC is operated as Link Master Device (LM); otherwise the following is displayed:
BASIC MODE,
NO LIVE_LIST

7. Technical data

Settings/programming of the Foundation Fieldbus interface	
Setting the Foundation Fieldbus address	The address is set via Foundation Fieldbus, using the specific system management services and a configuration software for Foundation Fieldbus (e.g. NI-FBUS).
Programmable feedback signal	The discrete feedback signals of the three Discrete Input (DI) function blocks within the AUMATIC may be configured to meet the requirements. The configuration is made via Foundation Fieldbus, using the AUMATIC device description and a configuration software for Foundation Fieldbus (e.g. NI-FBUS).
Programming of the AUMATIC user functions	The user functions of the AUMATIC (e.g. stepping mode, intermediate positions, ...) may either be programmed via the AUMATIC display or via Foundation Fieldbus using the AUMATIC device description and a configurations software for Foundation Fieldbus (e.g. NI-FBUS).
Function blocks of the AUMATIC Foundation Fieldbus interface	
Function blocks for control	1 Discrete Output Function Block (DOFB) for control with OPEN – STOP – CLOSE signals 1 Analog Output Function Block (AOFB) for control with a position setpoint[1)]
Function blocks for feedback signals	3 Discrete Input Function Blocks (DIFB) for 8 configurable discrete feedback signals. The following options are available: - End position OPEN, CLOSED - Selector switch in position LOCAL/REMOTE - Running indication [1)] (directional) - Torque switch OPEN, CLOSED - Limit switch OPEN, CLOSED - Digital (4) customer inputs - Intermediate positions (1 - 18) - Loss of phase - Thermal fault 1 Analog Input Function Block (AIFB) for feedback signal of the actual position value[1)] 1 Analog Input Function Block (AIFB) for feedback signal of the actual torque value[2)] 2 Analog Input function blocks (AIFB) for feedback signal of the 2 free 0 – 20 mA inputs (option)
Additional function blocks	1 Transducer Block (APVB) as connection block for control and programming of the AUMATIC 3 Discrete Input Transducer blocks (DITB) as connection blocks of the discrete feedback signals 2 Analog Input Transducer blocks (AITB) as connection blocks of the analogue feedback signals 1 Resource Block (RESOURCE) for the definition of the device characteristics 1 Process Controller block (PID) as function block for modulating applications
General data with Foundation Fieldbus	
Communication protocol	Foundation Fieldbus H1 (31.25 kbit/s) in accordance with EN 50170-4 or IEC 61158 Type 1/9
Physical Layer	Standard-power signalling, separately powered, non I.S.
Network topology	Line, star and tree structures (trunk lines combined with drop lines[3)]) are supported.
Transmission medium	Two-wire copper cable with data transmission and voltage supply on the same wire pair in accordance with - ISA S50.02-1992 ISA Physical Layer Standard or - IEC 61158-2:2000 (ed. 2.0), Fieldbus standard for use in industrial control systems, Part 2: Physical Layer specification and service definition Recommendation: use of A type cable (screened and twisted)
Foundation Fieldbus current consumption	Approx. 11 mA at + 24 V DC
Foundation Fieldbus transmission rate	31.25 kbit/s
Cable length	Max. 1,900 m (only when using the recommended A-type cable); with repeaters (4 pcs. max.) expandable up to a max. of 9.5 km
Number of devices	Max. of 32 devices per segment; a max. of 240 device may be addressed. Typical device number: approx. 6 – 15 devices per segment
Communication services	- Publisher/subscriber communication for the transmission of process data - Client/server communication for programming and configuration - Report Distribution for transmission of alarm signals
Supported Foundation Fieldbus functions	The AUMATIC is a Link Master device. Link Master devices can take over the Link Active Scheduler (LAS) function for the co-ordination of the bus communication.
Permissive connection	The AUMATIC offers an automatic polarity detection and correction of the Foundation Fieldbus cable.

1) Requires position transmitter in actuator
2) Requires magnetic limit and torque transmitter (MWG) in actuator
3) The internal drop line length within the AUMATIC amounts to 0.27 m.

8. Appendix A: Data link PDUs

Data Link Protocol Data Unit (DL PDUs) for Foundation Fieldbus:

Table 17

DLPDU	Name	Functionality
EC	Establish Connection	Connect DLCEP
DC	Disconnect Connection	Disconnect
CD	Compel Data	Poll a Publisher
DT	Data Transfer	Send a data unit
PT	Pass Token	Give the token
RT	Return Token	Return the token
RI	Request Interval	Request further pass token commands
PN	Probe Node	Search for new node
PR	Probe Response	Join the link
TD	Time Distribution	Time synchronisation
CT	Compel Time	Request CT
RQ	Round-trip Time Query	Measure delay in CT
RR	Round-trip Time Response	Receive delay time
CL	Claim LAS	Becomes LAS
TL	Transfer LAS	Request LAS role
IDLE	Idle	No activity

9. Appendix B: View objects

View objects are predefined parameter groupings which can be displayed via a user interface. The function block specification defines four views for each block type:

Table 18

View 1	Operation Dynamic	Information required by the plant user to operate the process
View 2	Operation Static	Information having to be read once to allow display together with the dynamic data.
View 3	All Dynamic	Information subject to change and having to be shown as detailed display
View 4	Other Static	Configuration and maintenance information

The views for each block are defined in appendix C.

10. Appendix C: Object dictionary

10.1. Start entries

Table 19

Index	Relative index	Parameters
0	–	Object dictionary and object description
1 – 14	–	Data types and data structures defined by Foundation Fieldbus
15 – 297	–	Not used/reserved
298	–	Index object 1
299	–	Index object 2

10.2. RESOURCE parameters

RESOURCE parameters								
Index	**Rel. Index**	**Parameter**	**View**				**Default values**	**Comments**
			1	2	3	4		
300	0	BLOCK					RESOURCE- - - - - - - - AC01- works number	This block contains data that is specific to the hardware that is associated with the resource block.
301	1	ST_REV	2	2	2	2	0x0000	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
302	2	TAG_DESC						The user description of the intended application of the block.
303	3	STRATEGY				2	0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
304	4	ALERT_KEY				1	0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
305	5	MODE_BLK	4		4			The current, desired, permitted, and normal block mode
306	6	BLOCK_ERR	2		2		0x8000 (OutOfService)	This parameter contains a summary of all block alarms.
307	7	RS_STATE	1		1		0x05 (Standby)	State of the function block application state machine
308	8	TEST_RW						Read/write test parameter – required for test only
309	9	DD_RESOURCE						Identification of Device Description for the device
310	10	MANUFAC_ID				4	0x000a01ff (AUMA)	Identification code of the device manufacturer
311	11	DEV_TYPE				2	0x01f8	Manufacturer's model designation for the device
312	12	DEV_REV				1	0x01	Revision of the device
313	13	DD_REV				1	0x01	Revision of device description
314	14	GRANT_DENY		2				Options for DCS access to device parameters
315	15	HARD_TYPES				2	0x000f (Scalar Input | Scalar Output | Discrete Input | Discrete Output)	The types of hardware available as channel numbers
316	16	RESTART					0x01 (Run)	Allows a manual restart to be initiated. Several degrees of restart are possible. 1: Run (operation) 2: Restart resource (restart device), 3: Restart with defaults 4: Restart processor
317	17	FEATURES				2	0x002e (Reports | Faultstate | Soft W Lock | Out Read-back)	Used to show supported resource block options.
318	18	FEATURE_SEL		2			0x002e (Reports | Faultstate | Soft W Lock | Out Read-back)	Used to select resource block options
319	19	CYCLE_TYPE				2	0x0003 (Scheduled | Block Execution)	Identifies the block execution methods available for this resource
320	20	CYCLE_SEL		2			0x0000	Used to select the block execution method for this resource.
321	21	MIN_CYCLE_T				4	0x00000640 ms	Time duration of the shortest cycle interval of which the resource is capable
322	22	MEMORY_SIZE				2	0x0000 Kbytes	Available device memory.
323	23	NV_CYCLE_T		4			0x00000000 ms	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.
324	24	FREE_SPACE		4			0%	Percent of memory available for further configuration. Zero in a preconfigured device.
325	25	FREE_TIME	4		4		0%	Percent of the block processing time that is free to process additional blocks
326	26	SHED_RCAS		4			0x0009c400 ms	Time duration at which to give up on computer writes to function block RCas locations.
327	27	SHED_ROUT		4			0x0009c400 ms	Time duration at which to give up on computer writes to function block ROut locations
328	28	FAULT_STATE	1		1		0x01 (Clear)	Condition set by loss of communcation to an output block failure promoted to an output block or a physical contact. When faultstate condition is set, then output function blocks will perform their FSTATE actions.
329	29	SET_FSTATE					0x01 (OFF)	Allows the faultstate condition to be manually initiated by selecting Set
330	30	CLR_FSTATE					0x01 (Off)	Writing a Clear to this parameter will clear the device faultstate state if the fault condition has cleared
331	31	MAX_NOTIFY				1	0x14	Maximum number of unconfirmed alert notify messages possible
332	32	LIM_NOTIFY		1			0x14	Maximum number of unconfirmed alert notify messages allowed

RESOURCE parameters								
Index	**Rel. Index**	**Parameter**	**View**				**Default values**	**Comments**
			1	2	3	4		
333	33	CONFIRM_TIME		4			0x0009c400 ms	The minimum time between retries of alert reports.
334	34	WRITE_LOCK		1			0x01 (Not Locked)	If set, no writes from anywhere are allowed except to clear WRITE_LOCK. Block inputs will continue to be updated.
335	35	UPDATE_EVT						This alarm is generated for each static data change.
336	36	BLOCK_ALM						Indicates the block-relevant alarms
337	37	ALARM_SUM	8		8			This parameter contains a summary of all block alarms.
338	38	ACK_OPTION				2	0x0000	Selection of whether alarms associated with the function block will be automatically acknowledged.
339	39	WRITE_PRI				1	0x00	Priority of the alarm generated by clearing the write lock (WRITE_LOCK).
340	40	WRITE_ALM						This alarm is generated when clearing the write lock (WRITE_LOCK).
341	41	ITK_VER				2	0x0004	Major revision number of the interoperability test case used to register this device.
342 - 349	-	unused/reserved						

10.3. PID parameters

PID parameters								
Index	**Rel. Index**	**Parameter**	**View**				**Default values**	**Comments**
			1	2	3	4		
350	0	BLOCK					PIDFB- - - - - - - - - - -AC01- works number	The Proportional Integral Derivative (PID) block is key to many control schemes. As long as an error exists the PID function will integrate the error which moves the output in a direction to correct the error.
351	1	ST_REV	2	2	2	2	0x0000	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
352	2	TAG_DESC						The user description of the intended application of the block.
353	3	STRATEGY				2	0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
354	4	ALERT_KEY				1	0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
355	5	MODE_BLK	4		4			The current, desired, permitted, and normal block mode
356	6	BLOCK_ERR	2		2		0x8002 (BlockConfiguration | OutOfService)	This parameter contains a summary of all block alarms.
357	7	PV	5		5			Primary Analog Value. This is the scaled setpoint.
358	8	SP	5		5			Setpoint. This is the nominal value for Auto Mode.
359	9	OUT	5		5			This is the block output value.
360	10	PV_SCALE		11				IN variable scaling (actual value)
361	11	OUT_SCALE		11				Block output scaling
362	12	GRANT_DENY		2				Options for DCS access to device parameters
363	13	CONTROL_OPTS				2	0x0000	Options for controller processing
364	14	STATUS_OPTS				2	0x0000	Options for status processing
365	15	IN			5			Current feedback (actual value)
366	16	PV_FTIME				4	0 Sec	Filter time constant for IN in seconds
367	17	BYPASS		2			0x00 (Uninitialized)	The normal PID control algorithm may be bypassed through this parameter.
368	18	CAS_IN	5		5			In Cascade mode, the setpoint is externally indicated. This is the input for the external setpoint.
369	19	SP_RATE_DN				5	1.#INF PV/Sec	Ramp rate at which downward setpoint changes are acted on in Auto mode in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto then the setpoint will be used immediately.
370	20	SP_RATE_UP				5	1.#INF PV/Sec	Ramp rate at which upward setpoint changes are acted on in Auto mode in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto then the setpoint will be used immediately.
371	21	SP_HI_LIM		4			100	The setpoint high limit is the highest setpoint operator entry that can be used for the block.

PID parameters								
Index	**Rel. Index**	**Parameter**	**View**				**Default values**	**Comments**
			1	2	3	4		
372	22	SP_LO_LIM		4			0	The setpoint low limit is the lowest setpoint operator entry that can be used for the block.
373	23	GAIN				4	0	Proportional part of PID algorithm
374	24	RESET				4	1.#INF Sec	The integral time constant in seconds per repeat.
375	25	BAL_TIME				4	0 Sec	This specifies the time for the internal working value of bias or ratio to return to the operator set bias or ratio in seconds. In the PID block it may be used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is Auto Cas or RCas.
376	26	RATE				4	0 Sec	Defines the derivative time constant in seconds
377	27	BKCAL_IN			5			Feedback value input of a downstream function block
378	28	OUT_HI_LIM		4			100	Limits the maximum output value for modes other than Manual
79	29	OUT_LO_LIM		4			0	Limits the minimum output value for modes other than Manual.
380	30	BKCAL_HYS				4	0.5 %	The amount that the block output must change away from its output limit before the limit status is turned off; expressed as a percent of the span of the output.
381	31	BKCAL_OUT			5			Feedback value being signalled back to the upstream function block within a cascade control.
382	32	RCAS_IN			5			In RCAS (Remote Cascade) mode, the setpoint is defined by a higher level DCS.
383	33	ROUT_IN			5			In ROUT (Remote Output) mode, the setpoint is defined by a higher level DCS, output as position value at OUT.
384	34	SHED_OPT				1	0x00 (Uninitialized)	Defines action to be taken on remote control device timeout
385	35	RCAS_OUT			5			This is the setpoint in RCAS (Remote Cascade) mode after having run through the limit and rising speed limitation. It is used for feedback to a higher level DCS.
386	36	ROUT_OUT			5			This is the position value in ROUT (Remote Output) mode. It is used for feedback to a higher level DCS.
387	37	TRK_SCALE				11	100	Scaling the TRK_VAL variable
388	38	TRK_IN_D	2		2			This discrete input is used to activate tracking.
389	39	TRK_VAL	5		5			The external tracking value is fed into this input.
390	40	FF_VAL			5			An external burst in fed into this input
391	41	FF_SCALE				11	100	Scaling the FF_VAL variable
392	42	FF_GAIN				4	0	The gain that the feed forward input is multiplied by before it is added to the calculated control output.
393	43	UPDATE_EVT						This alarm is generated for each static data change.
394	44	BLOCK_ALM						Indicates the block-relevant alarms
395	45	ALARM_SUM	8		8		0x0000	This parameter contains a summary of all block alarms.
396	46	ACK_OPTION				2	0x0000	Selection of whether alarms associated with the function block will be automatically acknowledged.
397	47	ALARM_HYS				4	0.5 %	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV.
398	48	HI_HI_PRI				1	0x00	Priority of the High High Alarm
399	49	HI_HI_LIM				4	1.#INF	Threshold for the High High Alarm
400	50	HI_PRI				1	0x00	Priority of the High Alarm
401	51	HI_LIM				4	1.#INF	Threshold for the High Alarm
402	52	LO_PRI				1	0x00	Priority of the Low Alarm
403	53	LO_LIM				4	-1.#INF	Threshold for the Low Alarm
404	54	LO_LO_PRI				1	0x00	Priority of the Low Low Alarm
405	55	LO_LO_LIM				4	-1.#INF	Threshold for the Low Low Alarm
406	56	DV_HI_PRI				1	0x00	Priority of the upper error variable alarm
407	57	DV_HI_LIM				4	1.#INF	Threshold for the upper error variable alarm
408	58	DV_LO_PRI				1	0x00	Priority of the lower error variable alarm
409	59	DV_LO_LIM				4	-1.#INF	Threshold for the lower error variable alarm
410	60	HI_HI_ALM						High High Alarm status and the associated time stamp
411	61	HI_ALM						High Alarm status and the associated time stamp
412	62	LO_ALM						Low Alarm status and the associated time stamp
413	63	LO_LO_ALM						Low Low Alarm status and the associated time stamp
414	64	DV_HI_ALM						Upper error variable alarm status and the associated time stamp
415	65	DV_LO_ALM						Lower error variable alarm status and the associated time stamp
416 - 419	-	unused/reserved						

10.4. AOFB parameters

AOFB parameters								
Index	**Rel. Index**	**Parameter**	**View**				**Default values**	**Comments**
			1	2	3	4		
420	0	BLOCK					AOFB- - - - - - - - - - -AC01-works number	The Analog Output (AO) block converts the value in setpoint (SP) to something useful for the hardware found at the channel (CHANNEL) selection.
421	1	ST_REV	2	2	2	2	0x0000	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
422	2	TAG_DESC						The user description of the intended application of the block
423	3	STRATEGY				2	0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
424	4	ALERT_KEY				1	0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
425	5	MODE_BLK	4		4			The current, desired, permitted, and normal block mode
426	6	BLOCK_ERR	2		2		0x8002 (Block-Configuration | OutOfService)	This parameter contains a summary of all block alarms.
427	7	PV	5		5			Primary Analog Value. This is the scaled setpoint.
428	8	SP	5		5			Setpoint. This is the nominal value for Auto Mode.
429	9	OUT	5		5			This is the block output value.
430	10	SIMULATE						This is a structure. The Simulate En//Disable sub-parameter can be used to switch a simulation on or off. If a simulation is active, the Simulate Value sub-parameter is taken as block input value.
431	11	PV_SCALE		1 1				IN variable scaling (actual value)
432	12	XD_SCALE		1 1				Block input scaling. By means of 100 % and 0 % values, the channel value is scaled to a percentage (Field_Val). The unit must correspond to the channel unit. DecPoint indicates the positions after the decimal point.
433	13	GRANT_DENY		2				Options for DCS access to device parameters
434	14	IO_OPTS				2	0x0000	Option which the user may select to alter input and output block processing.
435	15	STATUS_OPTS				2	0x0000	Options for status processing
436	16	READBACK	5		5			Readback signal of actuator command
437	17	CAS_IN	5		5			In Cascade mode, the setpoint is externally indicated. This is the input for the external setpoint.
438	18	SP_RATE_DN				5	1.#INF PV/Sec	Ramp rate at which downward setpoint changes are acted on in Auto mode in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto then the setpoint will be used immediately.
439	19	SP_RATE_UP				5	1.#INF PV/Sec	Ramp rate at which upward setpoint changes are acted on in Auto mode in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto then the setpoint will be used immediately.
440	20	SP_HI_LIM		4			100	The setpoint high limit is the highest setpoint operator entry that can be used for the block.
441	21	SP_LO_LIM		4			0	The setpoint low limit is the lowest setpoint operator entry that can be used for the block.
442	22	CHANNEL				2	0x0001	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
443	23	FSTATE_TIME				4	0 Sec	The time in seconds from detection of failure of the output block remote setpoint to the output action of the block output if the condition still exists.
444	24	FSTATE_VAL				4	0	The preset analog SP value to use when failure occurs. This value will be used if the I/O option Faultstate to value is selected. A value = 0 means hold last output value (Fail As Is).
445	25	BKCAL_OUT			5			Feedback value being signalled back to the upstream function block within a cascade control.
446	26	RCAS_IN			5			In RCAS (Remote Cascade) mode, the setpoint is defined by a higher level DCS.
447	27	SHED_OPT				1	0x00 (Uninitialized)	Defines action to be taken on remote control device timeout.

AOFB parameters								
Index	**Rel. Index**	**Parameter**	**View**				**Default values**	**Comments**
			1	2	3	4		
448	28	RCAS_OUT			5			This is the setpoint in RCAS (Remote Cascade) mode after having run through the limit and rising speed limitation. It is used for feedback to a higher level DCS.
449	29	UPDATE_EVT						This alarm is generated for each static data change.
450	30	BLOCK_ALM						Indicates the block-relevant alarms
451 459		unused/reserved						

10.5. DOFB parameters

DOFB parameters								
Index	**Rel. Index**	**Parameter**	**View**				**Default values**	**Comments**
			1	2	3	4		
460	0	BLOCK					DOFB- - - - - - - - - - - -AC01- works number	The Discrete Output (DO) block converts the value in the discrete setpoint (SP_D) to something useful for the hardware found at the channel (CHANNEL) selection.
461	1	ST_REV	2	2	2	2	0x0000	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
462	2	TAG_DESC						The user description of the intended application of the block
463	3	STRATEGY				2	0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
464	4	ALERT_KEY				1	0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
465	5	MODE_BLK	4		4			The current, desired, permitted, and normal block mode
466	6	BLOCK_ERR	2		2		0x8002 (BlockConfiguration | OutOfService)	This parameter contains a summary of all block alarms.
467	7	PV_D	2		2			Primary Analog Value. This is the scaled setpoint.
468	8	SP_D	5		5			Setpoint. This is the nominal value for Auto Mode.
469	9	OUT_D	2		2			This is the block output value.
470	10	SIMULATE_D						This is a structure. The Simulate En//Disable sub-parameter can be used to switch a simulation on or off. If a simulation is active, the Simulate Value sub-parameter is taken as block input value.
471	11	PV_STATE		2			0x0000	Index to the text describing the states of a discrete PV.
472	12	XD_STATE		2			0x0000	Index to the text describing the states of a discrete PV for the value obtained from the transducer.
473	13	GRANT_DENY		2				Options for DCS access to device parameters
474	14	IO_OPTS				2	0x0000	Options for block processing
475	15	STATUS_OPTS				2	0x0000	Options for status processing
476	16	READBACK_D	2		2			Readback signal of actuator command
477	17	CAS_IN	5		5			In Cascade mode, the setpoint is externally indicated. This is the input for the external setpoint.
478	18	CHANNEL				2	0x0002	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
479	19	FSTATE_TIME				4	0 Sec	The time in seconds from detection of failure of the output block remote setpoint to the output action of the block output if the condition still exists.
480	20	FSTATE_VAL_D				1	0x00	The preset analog SP value to use when failure occurs. This value will be used if the I/O option Faultstate to value is selected.
481	21	BKCAL_OUT_D			2			Feedback value being signalled back to the upstream function block within a cascade control.
482	22	RCAS_IN_D			2			In RCAS (Remote Cascade) mode, the setpoint is defined by a higher level DCS.
483	23	SHED_OPT				1	0x00 (Uninitialized)	Defines action to be taken on remote control device timeout.
484	24	RCAS_OUT_D			2			This is the setpoint in RCAS (Remote Cascade) mode after having run through the limit and rising speed limitation. It is used for feedback to a higher level DCS.
485	25	UPDATE_EVT						This alarm is generated for each static data change.
486	26	BLOCK_ALM						Indicates the block-relevant alarms

DOFB parameters									
Index	Rel. Index	Parameter	View				Default values	Comments
			1	2	3	4		
487 - 489	-	unused/reserved						

10.6. AIFB parameters

AIFB_1 - AIFB_4 parameters											
Index				Rel.	Parameter	View				Default values	Comments
AIFB_1	AIFB_2	AIFB_3	AIFB_4	Index		1	2	3	4		
490	530	570	610	0	BLOCK					AIFB_x- - - - - - - - - -AC01-works number	The Analog Input (AI) block takes the manufacturer's input data(selected by channel number) and makes it available to other function blocks at its output.
491	531	571	611	1	ST_REV	2	2	2	2	0x0000	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
492	532	572	612	2	TAG_DESC						The user description of the intended application of the block
493	533	573	613	3	STRATEGY				2	0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
494	534	574	614	4	ALERT_KEY				1	0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
495	535	575	615	5	MODE_BLK	4		4			The current, desired, permitted, and normal block mode
496	536	576	616	6	BLOCK_ERR	2		2		0x8002 (BlockConfiguration | OutOfService)	This parameter contains a summary of all block alarms.
497	537	577	617	7	PV	5		5			Primary Analog Value. This is the scaled setpoint.
498	538	578	618	8	OUT	5		5			This is the block output value.
499	539	579	619	9	SIMULATE						This is a structure. The Simulate En//Disable sub-parameter can be used to switch a simulation on or off. If a simulation is active, the Simulate Value sub-parameter is taken as block input value.
500	540	580	620	10	XD_SCALE		11				Block input scaling. By means of 100 % and 0 % values, the channel value is scaled to a percentage (Field_Val). The unit must correspond to the channel unit. DecPoint indicates the positions after the decimal point.
501	541	581	621	11	OUT_SCALE		11				Block output scaling
502	542	582	622	12	GRANT_DENY		2				Options for DCS access to device parameters
503	543	583	623	13	IO_OPTS				2	0x0000	Options for block processing
504	544	584	624	14	STATUS_OPTS				2	0x0000	Options for status processing
505	545	585	625	15	CHANNEL				2	AIFB_1=0x0003 AIFB_2=0x0004 AIFB_3=0x0005 AIFB_4=0x0006	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
506	546	586	626	16	L_TYPE				1	0x00 (Uninitialized)	Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect) or with square root (Ind Sqr Root) using the input range defined for the transducer and the associated output range.

AIFB_1 - AIFB_4 parameters											
Index				Rel.	Parameter	View				Default values	Comments
AIFB_1	AIFB_2	AIFB_3	AIFB_4	Index		1	2	3	4		
507	547	587	627	17	LOW_CUT				4	0	Limit used in square root processing. A value of zero percent of scale is used in block processing if the transducer value falls below this limit in % of scale. This feature may be used to eliminate noise near zero from a flow sensor.
508	548	588	628	18	PV_FTIME				4	0 Sec	Filter time constant for IN in seconds
509	549	589	629	19	FIELD_VAL	5		5			Input value percentage, scaled via XD_SCALE
510	550	590	630	20	UPDATE_EVT						This alarm is generated for each static data change.
511	551	591	631	21	BLOCK_ALM						Indicates the block-relevant alarms
512	552	592	632	22	ALARM_SUM	8		8			This parameter contains a summary of all block alarms.
513	553	593	633	23	ACK_OPTION				2	0x0000	Selection of whether alarms associated with the function block will be automatically acknowledged.
514	554	594	634	24	ALARM_HYS				4	0.5 %	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV.
515	555	595	635	25	HI_HI_PRI				1	0x00	Priority of the High High Alarm.
516	556	596	636	26	HI_HI_LIM				4	1.#INF	Threshold for the High High Alarm
517	557	597	637	27	HI_PRI				1	0x00	Priority of the High Alarm
518	558	598	638	28	HI_LIM				4	1.#INF	Threshold for the High Alarm
519	559	599	639	29	LO_PRI				1	0x00	Priority of the Low Alarm
520	560	600	640	30	LO_LIM				4	-1.#INF	Threshold for the Low Alarm
521	561	601	641	31	LO_LO_PRI				1	0x00	Priority of the Low Low Alarm
522	562	602	642	32	LO_LO_LIM				4	-1.#INF	Threshold for the Low Low Alarm
523	563	603	643	33	HI_HI_ALM						High High Alarm status and the associated time stamp
524	564	604	644	34	HI_ALM						High Alarm status and the associated time stamp
525	565	605	645	35	LO_ALM						Low Alarm status and the associated time stamp
526	566	606	646	36	LO_LO_ALM						Low Low Alarm status and the associated time stamp
527 - 529	567 - 569	607 - 609	647 - 649	-	unused/reserved						

10.7. DIFB parameters

DIFB_1 - DIFB_3 parameters										
Index			Rel.	Parameter	View				Default values	Comments
DIFB_1	DIFB_2	DIFB_3	Index		1	2	3	4		
650	680	710	0	BLOCK					DIFB_x- - - - - - - - - -AC01-works number	The Discrete Input (DI) block takes the manufacturer's discrete input data (selected by channel number) and makes it available to other function blocks at its output.
651	681	711	1	ST_REV	2	2	2	2	0x0000	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed..
652	682	712	2	TAG_DESC						The user description of the intended application of the block
653	683	713	3	STRATEGY				2	0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
654	684	714	4	ALERT_KEY				1	0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
655	685	715	5	MODE_BLK	4		4			The current, desired, permitted, and normal block mode
656	686	716	6	BLOCK_ERR	2		2		0x8002 (Block-Configuration | OutOfService)	This parameter contains a summary of all block alarms.
657	687	717	7	PV_D	2		2			Primary Analog Value. This is the scaled setpoint.
658	688	718	8	OUT_D	2		2			This is the block output value.
659	689	719	9	SIMULATE_D						This is a structure. The Simulate En//Disable sub-parameter can be used to switch a simulation on or off. If a simulation is active, the Simulate Value sub-parameter is taken as block input value.
660	690	720	10	XD_STATE		2			0x0000	Index to the text describing the states of a discrete PV for the value obtained from the transducer.
661	691	721	11	OUT_STATE		2			0x0000	Index to the text describing the states of a discrete PV.
662	692	722	12	GRANT_DENY		2				Options for DCS access to device parameters
663	693	723	13	IO_OPTS				2	0x0000	Options for block processing
664	694	724	14	STATUS_OPTS				2	0x0000	Options for status processing
665	695	725	15	CHANNEL				2	DIFB_1=0x0007 DIFB_2=0x0008 DIFB_3=0x0009	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
666	696	726	16	PV_FTIME				4	0 Sec	Filter time constant for IN in seconds
667	697	727	17	FIELD_VAL_D	2		2			Input value percentage, scaled via XD_SCALE
668	698	728	18	UPDATE_EVT						This alarm is generated for each static data change.
669	699	729	19	BLOCK_ALM						Indicates the block-relevant alarms
670	700	730	20	ALARM_SUM	8		8			This parameter contains a summary of all block alarms.
671	701	731	21	ACK_OPTION				2	0x0000	Selection of whether alarms associated with the function block will be automatically acknowledged.
672	702	732	22	DISC_PRI				1	0x00	Priority of the discrete alarms
673	703	733	23	DISC_LIM				1	0x00	State of discrete input which will generate an alarm.
674	704	734	24	DISC_ALM						
675 - 679	705 - 719	735 - 749	-	unused/reserved						

10.8. APVB parameters

APVB parameters																			
Index	Rel. Index	Parameter	View															Default values	Comments
			1	2	3				4										
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
750	0	BLOCK																	APVB ---------- AC01-works number	Transducer block comprises user parameter, the electronic name plate, and the operating data.
751	1	ST_REV	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0x001e	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
752	2	TAG_DESC																		The user description of the intended application of the block
753	3	STRATEGY							2										0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
754	4	ALERT_KEY							1										0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
755	5	MODE_BLK	4		4															The current, desired, permitted, and normal block mode
756	6	BLOCK_ERR	2		2														0x8000 (OutOfService)	This parameter contains a summary of all block alarms.
757	7	UPDATE_EVT																		This alarm is generated for each static data change.
758	8	BLOCK_ALM																		Indicates the block-relevant alarms
759	9	TRANSDUCER_DIRECTORY																	0x0000	This directory specifies the number of transducers within the transducer block and their start indices.
760	10	TRANSDUCER_TYPE	2	2	2				2										0x006a (Standard Advanced Positioner Valve)	Identifies the transducer
761	11	XD_ERROR	1		1														0x00	One of the transducer error codes defined in the FF Transducer Specifications, refer also to Appendix D: Error codes
762	12	COLLECTION_DIRECTORY																	0x00000000	A directory containing the number, starting index and DD item identifications of available data collection for each transducer within the transducer block.
763	13	FINAL_VALUE	5		5															Input setpoint of upstream AOFB
764	14	FINAL_VALUE_RANGE		11																Defines the upper and lower range limits of FINAL_VALUE. This value is identical with XD_SCALE of the AOFB and can't be written.
765	15	FINAL_VALUE_CUTTOFF_HI							4										100	If the FINAL_VALUE is greater than this value the actuator is operated to the minimum value of FINAL_VALUE_RANGE

APVB parameters																			
Index	Rel. Index	Parameter	View															Default values	Comments
			1	2	3				4										
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
766	16	FINAL_VALUE_CUTTOFF_LO							4										0	If the FINAL_VALUE is less than this value the actuator is operated to the minimum value of FINAL_VALUE_RANGE.
767	17	FINAL_POSITION_VALUE	5		5															Current actuator position
768	18	SERVO_GAIN							4										0	The servo PID gain value. Without effect in AUMATIC
769	19	SERVO_RESET							4										0 Sec	The servo PID reset value. Without effect in AUMATIC
770	20	SERVO_RATE							4										0 Sec	The servo PID rate value. Without effect in AUMATIC
771	21	ACT_FAIL_ACTION							1										0x00 (Uninitialized)	Actuator Fail Action. Without effect in AUMATIC
772	22	ACT_MAN_ID							4										0x000a01ff (AUMA)	The actuator manufacturer's identification number as defined by the Fieldbus Foundation.
773	23	ACT_MODEL_NUM							32										e.g.: AC 01,1	Product name of the AUMATIC; entered in the factory
774	24	ACT_SN							32										e.g.: 0305MA92401	Works number (serial number) of the AUMATIC; entered in the factory
775	25	VALVE_MAN_ID								4									0x00000000	The valve manufacturer's identification number as defined by the Fieldbus Foundation.
776	26	VALVE_MODEL_NUM								32										The valve model number
777	27	VALVE_SN								32										The valve serial number
778	28	VALVE_TYPE								1									0x00 (Uninitialized)	The type of the valve as defined in section 4.7 Valve type of Fieldbus Transducer Specifications (FF903)
779	29	XD_CAL_LOC									32									Physical location at which the last actuator calibration was performed
780	30	XD_CAL_DATE									7									The date of the last actuator calibration
781	31	XD_CAL_WHO									32									The name of the person responsible for the last actuator calibration
782	32	XD_ERROR_EXT				4													0x00000000	Refer to Appendix D: Error codes
783	33	FINAL_VALUE_D				2														Input setpoint of upstream DOFB
784	34	APPLICATION_RESET				1													0x00 (Uninitialized)	Resets the internal fault indications of the AUMATIC (e.g. torque faults or thermal faults which have occurred) the next time the APVB is executed. Set DO_APPLICATION_RESET to send command; the value changes automatically back to 0 after APVB execution.
785	35	ENABLE_LOCAL_CONTROLS										1							0x00	Parameter for configuration of the release of local controls
786	36	SEATING_MODE_CLOSE										1							0x00 (Limit)	Seating mode in end position CLOSE. This value has to be set in consent with the valve manufacturer!
787	37	SEATING_MODE_OPEN										1							0x00 (Limit)	Seating mode in end position OPEN. This value has to be set in consent with the valve manufacturer!

APVB parameters																				
Index	Rel. Index	Parameter	View																Default values	Comments
			1	2	3				4											
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
788	38	TORQUE_E6										1							0x02 (MWG)	Source for torque value E6. Set in the factory
789	39	TORQUE_OPENING										1							0x21 %	Tripping torque OPEN in percent of the nominal actuator torque (refer to parameter with Index 791). Only effective if the actuator is equipped with an MWG (refer to parameter with Index 795). This value has to be set in consent to the valve manufacturer!
790	40	TORQUE_CLOSING										1							0x21 %	Tripping torque CLOSE in percent of the nominal actuator torque (refer to parameter with Index 792). Only effective if the actuator is equipped with an MWG (refer to parameter with Index 795). This value has to be set in consent to the valve manufacturer!
791	41	NOMINAL_TORQUE_OPENING										2							0x001e Nm	Nominal torque in direction OPEN of actuator in Nm, needed for display indication of torque value in Nm resp. lbsft. Display indication of AUMATIC: MAX.TORQUE OPEN. Set in the factory (depending on type of actuator).
792	42	NOMINAL_TORQUE_CLOSING										2							0x001e Nm	Nominal torque in direction CLOSE of actuator in Nm, needed for display indication of torque value in Nm resp. lbsft. Display indication of AUMATIC: MAXIMUM TORQUE. Set in the factory (depending on type of actuator).
793	43	BY_PASS_DURATION										1							0x00 x 100ms	By-pass duration of the torque monitoring during actuator start-up
794	44	SETPOINT_E1										1							0x0d (Foundation Fieldbus)	Source of setpoint E1 (for positioner). Set in the factory
795	45	FEEDBACK_E2										1							0x04 (MWG)	Source of feedback E2 (display indication of AUMATIC: FEEDBACK E2). The AUMATIC needs to have a actuator position feedback E2 signal, either Potentiometer (1), 0/4-20mA RWG (2/3) or MWG (4). Set in the factory (depending on the actuator).
796	46	POSITIONER										1							0x01 (Positioner enabled)	Availability of positioner function. Mandatory setting for Foundation Fieldbus: “Positioner enabled”. Set in the factory.
797	47	ADAPTIVE_BEHAVIOUR										1							0x01(On)	Adaptive behaviour of the positioner. If this adaptive behaviour is switched off the parameters with Index 799, 800 and 801 are to be set with adequate values.
798	48	DEAD_TIME_T_OFF										2							0x0005 x 100ms	Dead time of the positioner. Set this parameter to ensure that the maximum number of starts of the actuator is not exceeded.

APVB parameters																				
Index	Rel. Index	Parameter	View																Default values	Comments
			1	2	3				4											
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
799	49	CLOSING_DEADBAND										4							0.5 %	Deadband in direction OPEN. No relevance when adaptive positioner is used (refer to parameter with Index 796)!
800	50	OPENING_DEADBAND										4							0.5 %	Deadband in direction CLOSE. No relevance when adaptive positioner is used (refer to parameter with Index 796)!
801	51	OUTER_DEADBAND										4							1%	Outer deadband. No relevance when adaptive positioner is used (refer to parameter with Index 796)!
802	52	REVERSING_TIME										2							0x012c ms	Reversing time. Set in the factory
803	53	FAILURE_BEHAVIOUR											1						0x00 (Off)	Configuration of failure behaviour
804	54	FAILURE_DELAY_TIME											2						0x001e x 100ms	Delay time for failure behaviour
805	55	FAILURE_ACTION											1						0x00 (Fail as is)	Reaction of the actuator when the failure behaviour is active (display indication of AUMATIC: FAILURE POSITION).
806	56	FAILURE_POSITION											4						0%	Preset position for failure behaviour.
807	57	FAILURE_SOURCE											1						0x00 (Setpoint E1)	Failure source for failure behaviour. Prefer either “Setpoint E1" or ”E1 or E2 feedback" for fail action
808	58	IO_STACK_2											1						0x00 (None)	Type of a second interface installed which might be installed in addition to the Foundation Fieldbus interface board. Set in the factory
809	59	EXTERNAL_INPUT_BUS											1						0x00 (Standard)	Availability of the function for additional bus inputs (AUMATIC display indication: ETERNAL INPUTS BUS).
810	60	EMERGENCY_BEHAVIOUR											1						0x00 (Off)	Configuration of emergency behaviour. In order to utilize the emergency function the AUMATIC has to be equipped with an hardwired emergency NOT/EMERGENCY input (refer to the wiring diagram).
811	61	EMERGENCY_ACTION											1						0x00 (Fail as is)	Actuator reaction in case of emergency (display indication of AUMATIC EMERGENCY POSITION).
812	62	EMERGENCY_POSITION											4						0%	Preset position for emergency behaviour. Setting only required if the parameter EMERGENCY_ACTION (index 811) is set to “Fail to preset”.
813	63	EMERGENCY_SELECTOR_SWITCH											1						0x00 (REMOTE only)	Determines the emergency behaviour dependency on the selector switch position
814	64	EMERGENCY_BY_PASS											1						0x00 (0x00)	Configuration of possible by-pass signals (by-pass of torque faults and/or thermal faults) during emergency. Set in the factory
815	65	MONITOR_TRIGGERS											1						0x00 (Function not active)	Activation of monitoring functions triggers (Warning start/duty and operation time monitoring)

APVB parameters																				
Index	Rel. Index	Parameter	View																Default values	Comments
			1	2	3				4											
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
816	66	MAX_START_HOUR											2						0x04b0 x 1/h	If the maximum starts per hour is exceeded, the warning indication STARTS/DUTY is shown at the local display of the AUMATIC. Setting is only required if parameter MONITOR_TRIGGERS is set to “Function active”.
817	67	MAX_DUTY_CYCLE											1						0x00 (15 min)	If the maximum duty cycle is exceeded, the warning indication STARTS/DUTY is shown at the local display of the AUMATIC. Setting is only required if parameter MONITOR_TRIGGERS is set to “Function active”.
818	68	MAX_RUNTIME											2						0x0384 Sec	If the motor running time is exceeded the warning indication OPERATION TIME is shown at the local display of the AUMATIC. Setting is only required if parameter MONITOR_TRIGGERS is set to “Function active”.
819	69	REACTION_MONITORING											1						0x00 (Function not active)	Monitors the reaction of the actuator via position feedback. Set in the factory
820	70	REACTION_TIME											1						0x46 x 100ms	Reaction monitoring time (display indication in AUMATIC: REACTION TIME). Setting is only required if parameter REACTION_MONITORING (index 819) is set to “Function active”.
821	71	STEP_MODE_OPEN												1					0x00 (Off)	Configuration of the stepping mode in direction OPEN. With stepping mode the operating time can be increased for the entire or any part of the valve travel.
822	72	ON_TIME_OPEN												2					0x000a x 100ms	On time of the stepping mode in direction OPEN
823	73	OFF_TIME_OPEN												2					0x0032 x 100ms	Off time of the stepping mode in direction OPEN
824	74	START_STEP_OPEN												4					0%	Start of stepping range for stepping mode in direction OPEN
825	75	STOP_STEP_OPEN												4					100%	End of stepping range for stepping mode in direction OPEN
826	76	STEP_MODE_CLOSE												1					0x00 (Off)	Configuration of the stepping mode in direction CLOSE. With stepping mode the operating time can be increased for the entire or any part of the valve travel.
827	77	ON_TIME_CLOSE												2					0x000a x 100ms	On time of stepping mode in direction CLOSE
828	78	OFF_TIME_CLOSE												2					0x0032 x 100ms	Off time of the stepping mode in direction CLOSE
829	79	START_STEP_CLOSE												4					100%	Start of stepping range for stepping mode in direction CLOSE
830	80	STOP_STEP_CLOSE												4					0%	End of stepping range for stepping mode in direction CLOSE

APVB parameters																				
Index	Rel. Index	Parameter	View																Default values	Comments
			1	2	3				4											
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
831	81	POS_DIRECTRUNNING												1					0x00 (Function not active)	Availability of the function for approaching intermediate positions with direct operation commands (e.g.: multiport valve function, display indication of AUMATIC: POS.DIRECTRUNNING). Set in the factory. If activated all the parameters configuring the intermediate positions are to be set to adequate values.
832	82	POS_1												4					0%	Intermediate psotion no. 1 (display indication of AUMATIC: POS.1 BEHAVIOUR)
833	83	POS_1_BEHAVIOUR												1					0x00 (No Stop)	Actuator behaviour on reaching the intermediate position no. 1 (display indication of AUMATIC: POS.1 BEHAVIOUR)
834	84	POS_1_SELECTOR_SW												1					0x00 (Off)	Activation of intermediate position no. 1 (display indication of AUMATIC: POS.1 SELECTOR SW)
835	85	POS_1_CONTROL												1					0x00 (NOT USED)	Signal behaviour in intermediate position no .1 (display indication of AUMATIC: POS.1 CONTROL).
836	86	POS_2												4					0%	Intermediate position no. 2 (display indication of AUMATIC: POS.2)
837	87	POS_2_BEHAVIOUR												1					0x00 (No Stop)	Actuator behaviour on reaching the intermediate position no. 2 (display indication of AUMATIC: POS.2 BEHAVIOUR)
838	88	POS_2_SELECTOR_SW												1					0x00 (Off)	Activation of intermediate position no. 2 (display indication of AUMATIC: POS." SELECTOR SW)
839	89	POS_2_CONTROL												1					0x00 (NOT USED)	Signal behaviour in intermediate position no. 2 (display indication of AUMATIC: POS.2 CONTROL).
840	90	POS_3												4					0%	Intermediate position no. 3 (display indication of AUMATIC: POS.3)
841	91	POS_3_BEHAVIOUR												1					0x00 (No Stop)	Actuator behaviour on reaching the intermediate position no. 3 (display indication of AUMATIC: POS.3 BEHAVIOUR)
842	92	POS_3_SELECTOR_SW												1					0x00 (Off)	Activation of intermediate position no. 3 (display indication of AUMATIC: POS.3 SELECTOR SW)
843	93	POS_3_CONTROL												1					0x00 (NOT USED)	Signal behaviour in intermediate position no. 3 (display indication of AUMATIC: POS.3 CONTROL)
844	94	POS_4												4					0%	Intermediate position no. 4 (display indication of AUMATIC: POS.4)
845	95	POS_4_BEHAVIOUR												1					0x00 (No Stop)	Actuator behaviour on reaching the intermediate position no. 4 (display indication of AUMATIC: POS.4 BEHAVIOUR)
846	96	POS_4_SELECTOR_SW												1					0x00 (Off)	Activation of intermediate position no. 4 (display indication of AUMATIC: POS.4 SELECTOR SW)

APVB parameters																				
Index	Rel. Index	Parameter	View																Default values	Comments
			1	2	3				4											
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
847	97	POS_4_CONTROL												1					0x00 (NOT USED)	Signal behaviour in intermediate position no. 4 (display indication of AUMATIC: POS.4 CONTROL)
848	98	POS_5													4				0%	Intermediate position no. 5 (display indication of AUMATIC: POS.5)
849	99	POS_5_BEHAVIOUR													1				0x00 (No Stop)	Actuator behaviour on reaching the intermediate position no. 5 (display indication of AUMATIC: POS.5 BEHAVIOUR)
850	100	POS_5_SELECTOR_SW													1				0x00 (Off)	Activation of intermediate position no. 5 (display indication of AUMATIC: POS.5 SELECTOR SW)
851	101	POS_5_CONTROL													1				0x00 (NOT USED)	Signal behaviour in intermediate position no. 5 (display indication of AUMATIC: POS.5 CONTROL)
852	102	POS_6													4				0%	Intermediate position no. 6 (display indication of AUMATIC: POS.6)
853	103	POS_6_BEHAVIOUR													1				0x00 (No Stop)	Actuator behaviour on reaching the intermediate position no. 6 (display indication of AUMATIC: POS.6 BEHAVIOUR)
854	104	POS_6_SELECTOR_SW													1				0x00 (Off)	Activation of intermediate position no. 6 (display indication of AUMATIC: POS.6 SELECTOR SW)
855	105	POS_6_CONTROL													1				0x00 (NOT USED)	Signal behaviour in intermediate position no. 6 (display indication of AUMATIC: POS.6 CONTROL)
856	106	POS_7													4				0	Intermediate position no. 7 (display indication of AUMATIC: POS.7)
857	107	POS_7_BEHAVIOUR													1				0x00 (No Stop)	Actuator behaviour on reaching the intermediate position no. 7 (display indication of AUMATIC: POS.7 BEHAVIOUR)
858	108	POS_7_SELECTOR_SW													1				0x00 (Off)	Activation of intermediate position no. 7 (display indication of AUMATIC: POS.7 SELECTOR SW)
859	109	POS_7_CONTROL													1				0x00 (NOT USED)	Signal behaviour in intermediate position no. 7 (display indication of AUMATIC: POS.7 CONTROL)
860	110	POS_8													4				0%	Intermediate position no. 8 (display indication of AUMATIC: POS.8)
861	111	POS_8_BEHAVIOUR													1				0x00 (No Stop)	Actuator behaviour on reaching the intermediate position no. 8 (display indication of AUMATIC: POS.8 BEHAVIOUR)
862	112	POS_8_SELECTOR_SW													1				0x00 (Off)	Activation of intermediate position no. 8 (display indication of AUMATIC: POS.8 SELECTOR SW)
863	113	POS_8_CONTROL													1				0x00 (NOT USED)	Signal behaviour in intermediate position no. 8 (display indication of AUMATIC: POS.8 CONTROL)

APVB parameters																				
Index	Rel. Index	Parameter	View																Default values	Comments
			1	2	3				4											
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
864	114	COMMISSION_AUMATIC													20				e.g.: 5101558	Commission no. of the AUMATIC, entered in the factory
865	115	COMMISSION_ACTUATOR													20				e.g.: 5101558	Commission no. of the actuator, entered in the factory
866	116	KKS													20				_kksnr_	Power plant identification system number of the AUMATIC
867	117	NO_VALVE														20			_armaturennr_	Valve number of the AUMATIC.
868	118	NO_PLANT														20			_anlagennr_	Plant identification
869	119	LOGIK SW-VERSION														20			e.g.: Z031.922/xx-xx	Software version of logic board in the AUMATIC; entered in the factory
870	120	LOGIK HW-VERSION														20			e.g.: Z031.773/xx	Hardware version of logic board in the AUMATIC; entered in the factory
871	121	DATE_FINAL_TEST														20			e.g.: 18.02.2005	Date of final test of the AUMATIC; entered after final test
872	122	WIRING_DIAGRAM															20		e.g.: ACP11F1-2M0—B000	ACP wiring diagram number of the AUMATIC; entered in the factory
873	123	TERMINAL_PLAN															20		e.g.: TP180/001	Terminal plan number of the AUMATIC; entered in the factory
874	124	CUSTOMER_PROJECT_NAME															20		_project_name_	Project identification
875	125	CUSTOMER_FIELD_1															20		_customer_field1_	Freely available for customer entries, field no. 1
876	126	CUSTOMER_FIELD_2															20		_customer_field2_	Freely available for customer entries, field no. 2
877	127	SERVICE_PHONE																20	e.g.: +49 2234 20379-00	Service phone of the nearest service centre
878	128	SERVICE_URL																20	e.g.: www.auma.com	AUMA Internet address
879	129	SERVICE_TEXT_1																20	_servicetext1_	For service entries, field no. 1
880	130	SERVICE_TEXT_2																20	_servicetext2_	For service entries, field no. 2
881	131	TOTAL_MOTOR_RUNTIME					4												0x00000000	Operational data (cannot be reset). Motor running time during lifetime
882	132	TOTAL_STARTS					4												0x00000000	Operational data (cannot be reset). Number of starts during lifetime
883	133	TOTAL_TSC_STOPS					4												0x00000000	Operational data (cannot be reset). Total number of TSC stops during lifetime
884	134	TOTAL_LSC_STOPS					4												0x00000000	Operational data (cannot be reset). Total number of LSC stops during lifetime
885	135	TOTAL_TSO_STOPS					4												0x00000000	Operational data (cannot be reset). Total number of TSO stops during lifetime
886	136	TOTAL_LSO_STOPS					4												0x00000000	Operational data (cannot be reset). Total number of LSO stops during lifetime
887	137	TOTAL_TSC_FAULTS					4												0x00000000	Operational data (cannot be reset). Total number of TSC faults during lifetime
888	138	TOTAL_TSO_FAULTS					4												0x00000000	Operational data (cannot be reset). Total number of TSO faults during lifetime
889	139	TOTAL_THERMAL_FAULTS					4												0x00000000	Operational data (cannot be reset).Total number of thermal faults during lifetime

APVB parameters																				
Index	Rel. Index	Parameter	View																Default values	Comments
			1	2	3				4											
					1	2	3	4	1	2	3	4	5	6	7	8	9	10	AVP	
890	140	TOTAL_WRN_STARTS_RUN2					4												0x00000000	Operational data (cannot be reset). Max. total of all times during which the warning indication STARTS/RUN was shown at the AUMATIC display (over lifetime)
891	141	TOTAL_WRN_STARTS_RUN1					4												0x00000000	Operational data (cannot be reset). Total of all times during which the warning indication STARTS/DUTY was shown at the AUMATIC display (over lifetime)
892	142	TOTAL_NO_POWER_ON					4												0x00000001	Operational data (cannot be reset). Total number of AUMATIC switch on procedures during lifetime
893	143	USR_MOTOR_RUNTIME						4											0x00000000	Operational data (can be reset by writing a 0). Motor running time
894	144	USR_STARTS						4											0x00000000	Operational data (can be reset by writing a 0). Number of starts
895	145	USR_TSC_STOPS						4											0x00000000	Operational data (can be reset by writing a 0). Number of TSC stops
896	146	USR_LSC_STOPS						4											0x00000000	Operational data (can be reset by writing a 0). Number of LSC stops
897	147	USR_TSO_STOPS						4											0x00000000	Operational data (can be reset by writing a 0). Number of TSO stops
898	148	USR_LSO_STOPS						4											0x00000000	Operational data (can be reset by writing a 0). Number of LSO stops
899	149	USR_TSC_FAULTS						4											0x00000000	Operational data (resetable by writing a 0). Number of TSC faults
900	150	USR_TSO_FAULTS						4											0x00000000	Operational data (can be reset by writing a 0). Number of TSO faults
901	151	USR_THERMAL_FAULTS						4											0x00000000	Operational data can be reset by writing a 0). Number of thermal faults
902	152	USR_WRN_STARTS_RUN2						4											0x00000000	Operational data (can be reset by writing a 0). Total of all times duing which the warning indication STARTS/ DUTY was shown at the AUMATIC display
903	153	USR_WRN_STARTS_RUN1						4											0x00000000	Operational data (can be reset by writing a 0). Total of all times during which the warning indication STARTS/DUTY was shown at the AUMATIC display.
904	154	USR_NO_POWER_ON						4											0x00000001	Operational data (can be reset by writing a 0). Number of AUMATIC switch on procedures
905–949	-	unused/reserved																		

10.9. AITB parameters

AITB_1 and AITB_2 parameters									
Index		Rel.	Parameter	View				Default values	Comments
ATB_1	ATB_2	Index		1	2	3	4		
950	970	0	BLOCK					AITB_x----------AC01-works number)	Transducer blocks for the Analog Input Function Blocks.
951	971	1	ST_REV	2	2	2	2	0x0000	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
952	972	2	TAG_DESC						The user description of the intended application of the block
953	973	3	STRATEGY				2	0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
954	974	4	ALERT_KEY				1	0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
955	975	5	MODE_BLK	4		4			The current, desired, permitted, and normal block mode
956	976	6	BLOCK_ERR	2		2		0x8000 (OutOfService)	This parameter contains a summary of all block alarms.
957	977	7	UPDATE_EVT						This alarm is generated for each static data change
958	978	8	BLOCK_ALM						Indicates the block-relevant alarms
959	979	9	TRANSDUCER_DIRECTORY					0x0000	This directory specifies the number of transducers within the transducer block and their start indices.
960	980	10	TRANSDUCER_TYPE	2	2	2	2	0xffff (Other)	Identifies the transducer
961	981	11	XD_ERROR	1		1		0x00	One of the transducer error codes defined in the FF Transducer Specifications, refer also to Appendix D: Error codes
962	982	12	COLLECTION_DIRECTORY					0x00000000	A directory containing the number, starting index and DD item identifications of available data collection for each transducer within the transducer block.
963	983	13	PRIMARY_VALUE	5		5			Type of measuring value of the primary variable
964	984	14	XD_ERROR_EXT	4		4		0x00000000	Refer to Appendix D: Error codes
965 - 969	985 - 989	-	unused/reserved						

10.10. DITB parameters

DIFB_1 - DIFB_3 parameters										
Index			Rel. Index	Parameter	View				Default values	Comments
DIFB_1	DIFB_2	DIFB_3			1	2	3	4		
990	1020	1050	0	BLOCK					DITB_x- - - - - - - - - -AC01-works number)	Transducer blocks for the discrete input function blocks.
991	1021	1051	1	ST_REV	2	2	2	2	0x0000	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
992	1022	1052	2	TAG_DESC						The user description of the intended application of the block
993	1023	1053	3	STRATEGY				2	0x0000	The strategy field can be used to identify grouping of blocks, assigning the same reference number for each block of a group. This data is not checked or processed by the block.
994	1024	1054	4	ALERT_KEY				1	0x00	The identification number of the plant unit. This information may be used in the host for sorting alarms etc.
995	1025	1055	5	MODE_BLK	4		4			The current, desired, permitted, and normal block mode
996	1026	1056	6	BLOCK_ERR	2		2		0x8000 (OutOfService)	This parameter contains a summary of all block alarms.
997	1027	1057	7	UPDATE_EVT						This alarm is generated for each static data change.
998	1028	1058	8	BLOCK_ALM						Indicates the block-relevant alarms
999	1029	1059	9	TRANSDUCER_DIRECTORY					0x0000	This directory specifies the number of transducers within the transducer block and their start indices.
1000	1030	1060	10	TRANSDUCER_TYPE	2	2	2	2	0xffff (Other)	Identifies the transducer
1001	1031	1061	11	XD_ERROR	1		1		0x00 (0x00)	One of the transducer error codes defined in the FF Transducer Specifications, refer also to Appendix D: Error codes
1002	1032	1062	12	COLLECTION_DIRECTORY					0x00000000	A directory containing the number, starting index and DD item identifications of available data collection for each transducer within the transducer block.
1003	1033	1063	13	PRIMARY_VALUE_D	5		5			The primary measuring value is the flow rate.
1004	1034	1064	14	XD_ERROR_EXT	4		4		0x00000000 (0x00000000)	Refer to Appendix D: Error codes
1005	1035	1065	15	DI_SOURCE_BIT_1				1	0x00 (Uninitialized)	This parameter is used to define discrete feedback of bit 1.
1006	1036	1066	16	DI_SOURCE_BIT_2				1	0x00 (Uninitialized)	This parameter is used to define discrete feedback of bit 2.
1007	1037	1067	17	DI_SOURCE_BIT_3				1	0x00 (Uninitialized)	This parameter is used to define discrete feedback of bit 3.
1008	1038	1068	18	DI_SOURCE_BIT_4				1	0x00 (Uninitialized)	This parameter is used to define discrete feedback of bit 4.
1009	1039	1069	19	DI_SOURCE_BIT_5				1	0x00 (Uninitialized)	This parameter is used to define discrete feedback of bit 5.
1010	1040	1070	20	DI_SOURCE_BIT_6				1	0x00 (Uninitialized)	This parameter is used to define discrete feedback of bit 6.
1011	1041	1071	21	DI_SOURCE_BIT_7				1	0x00 (Uninitialized)	This parameter is used to define discrete feedback of bit 7.
1012	1042	1072	22	DI_SOURCE_BIT_8				1	0x00 (Uninitialized)	This parameter is used to define discrete feedback of bit 8.
1013 – 1019	1042 – 1049	1073 – 1089	–	Unused / Reserved						

10.11. Indices of link objects

Index	Rel. Index	Parameters
1090 – 1111	–	Link Object 1 – Link Object 22
1112 – 1129	–	Unused/reserved

10.12. Parameters of a link object

Subindex	Designation	Description
1	Local Index	Local Index - Local index is the index of the local object associated with this link object. When set to zero, it means that the link object is associated with a one or more objects as identified by Service type rather than a particular instance of an object (for Trend and Alert).
2	VCR Nummer	Specifies the local OD index of the Virtual Communication Relationship List (VCRL) entry that is to be used by the function block application when using FMS or function block services mapped to FMS. For local transfer between two resources within a field device, the VCR number is used to identify the resource containing the remote index. Transfers within a resource or between resources within a fieldbus device are locally defined. If set to “0”,this link object is not used.
3	Remote Index	Remote index is the index of the remote object associated with this link object. When set to zero, it means that the remote index is not applicable e.g. is an interface device.
4	Service Operation	Service operation defines the type of services that can use this link object. When the local index is zero, it means that the service specified can operate on a group of objects rather than a single instance of an object.
5	Stale Count Limit	The stale count limit defined the maximum number of consecutive stale input values that may be received. When the number of consecutive stale input values reaches or exceeds this limit, then the status associated with the input value will be set to Bad. If the stale count limit is set to zero, then no detection of stale data is required. Setting of “2" or larger value is recommended to avoid unnecessary mode transfer which is caused when subscriber failed to receive data correctly.

0	1	2	3	4	5	6	7
Undefined	Local	Publisher	Subscriber	Client	Server	Alert	Trend

10.13. Indices of alert objects

Index	Rel. Index	Parameter
1130	–	Alert Object
1131	–	Alert Object
1132	–	Alert Object
1133 – 1169	–	Unused/reserved

10.14. Indices of trend objects

Index	Rel. Index	Parameter
1170 – 1183	–	Trend Object Float 1 – Trend Object Float 14
1184 – 1190	–	Trend Object Discrete 1 – Trend Object Discrete 7
1191 – 1209	–	Unused/Reserved

10.15. Trend object parameters

Subindex	Designation	Description
1	Block Index	The OD index of the block containing the parameter to be trended
2	Relative Index	The relative index of the input or output parameter to be used in collecting short term history. A zero value will indicate that the trend is unconfigured
3	Sample Type	Based on the specified sample type, the instantaneous value is collected or the average value between samples. If average values are collected, then the status will represent the highest priority status between samples. 1. Sampled upon execution of a function block. 2. The average value is sampled.
4	Sample Interval	Sample time defined for a trend object must be an integer multiple of the execution period of the block containing. The parameter to be trended in 1/32 milliseconds
5	Last Update	Time at which the newest sample was saved.
6 – 21	List of Status Samples	Samples of status in time order with attribute 6 the newest sample status.
22 – 37	List of Value Samples	Samples of value in time order with attribute 22 the newest sample value.

10.16. Indices of view objects

Index				Rel. Index	Parameter
View1	View2	View3	View4		
1210	1211	1212	1213	–	RESOURCE View Objects
1214 – 1219				–	Unused / Reserved
1220	1221	1222	1223	–	PID View Objects
124 – 1229				–	Unused / Reserved
1230	1231	1232	1233	–	AOFB View Objects
1234 – 1239				–	Unused / Reserved
1240	1241	1242	1243	–	DOFB View Objects
1244 – 1249				–	Unused / Reserved
Jun 03	1251	1252	1253	–	AIFB_1 View Objects
1254 – 1259				–	Unused / Reserved
1260	1261	1262	1263	–	AIFB_2 View Objects
1264 – 1269				–	Unused / Reserved
1270	1271	1272	1273	–	AIFB_3 View Objects
1274 – 1279				–	Unused / Reserved
1280	1281	1282	1283	–	AIFB_4 View Objects
1284 – 1289				–	Unused / Reserved
1290	1291	1292	1293	–	DIFB_1 View Objects
1294 – 1299				–	Unused / Reserved
1300	1301	1302	1303	–	DIFB_2 View Objects
1304 – 1309				–	Unused / Reserved
1310	1311	1312	1313	–	DIFB_3 View Objects
1314 – 1329				–	Unused / Reserved
1330	1331	1332	1336	–	APVB View Objects
		1333	1337	–	
		1334	1338	–	
		1335	1339	–	
			1340	–	
			1341	–	
			1342	–	
			1343	–	
			1344	–	
			1345	–	
1346 – 1349			–		Unused / Reserved

Index				Rel. Index	Parameter
View1	View2	View3	View4		
1350	1351	1352	1353	–	AITB_1 View Objects
1354 – 1359			–		Unused / Reserved
1360	1361	1362	1363	–	AITB_2 View Objects
1364 – 1369			–		Unused / Reserved
1370	1371	1372	1373	–	DITB_1 View Objects
1374 – 1379			–		Unused / Reserved
1380	1381	1382	1383	–	DITB_2 View Objects
1384 – 1389			–		Unused / Reserved
1390	1391	1392	1393	–	DITB_3 View Objects

11. Appendix D: Error codes

Some of the fault conditions may appear in different XD_ERROR levels. In such cases, always the level with the highest XD_ERROR value will become active.

Value XD_ERROR	Value XD_ERROR_EXT	Description
0 (0x00) (No error)	0x00000000 (No error)	The actuator can be operated via Foundation Fieldbus.

Affected blocks: APVB APVB.FINAL_POSITION_VALUE.Status = Good_Cascade/LocalOverride

Value XD_ERROR	Value XD_ERROR_EXT	Description
17 (0x11) (General error)	0x00000001 (Torque fault OPEN)	Torque fault in OPEN direction. Refer to AUMATIC display, status indication `S1 - FAULT IND.` Description of displays: `TORQUE FAULT (OPEN)` Corrective measure: Issue operation command in direction CLOSE. If the torque present is smaller than the preset tripping torque (TORQUE_OPENING, parameter index 789): - press **Reset** push button in selector switch position LOCAL. - or via APPLICATION RESET parameter of APVB (index 784).
17 (0x11) (General error)	0x00000002 (Torque fault CLOSE)	Torque faut in CLOSE direction. Refer to AUMATIC display, status indication `S1 - FAULT IND.` Description of displays: `TORQUE FAULT (CLOSE)` Corrective measure: Issue operation command in direction OPEN. If the torque present is smaller than the preset tripping torque (TORQUE_CLOSING, parameter index 790): - press **Reset** push button in selector switch position LOCAL. - or via APPLICATION RESET parameter of APVB (index 784).

17 (0x11) (General error)	0x00000010 (Not ready indication)	The actuator is not available for external operation via Foundation Fieldbus.
		Refer to AUMATIC display, status indication `S3 - NOT READY IND.`
		Description of displays:
		`NOT REMOTE`
		Selector switch is in position LOCAL or OFF (0).
		Corrective measure: Set selector switch to position REMOTE.
		`EMERGENCY MODE`
		The EMERGENCY operation mode is active.
		Corrective measure: apply + 24 V DC at NOT/EMERGENCY input,
		or deactivate EMERGENCY operation via Foundation Fieldbus parameter EMERGENCY of APVB (index 810, 811, 812, and 813) or the display of the AUMATIC.
		`EXTERNAL CONTROLS`
		The actuator is controlled via a parallel interface (combination Fieldbus - Standard interface) - only if either the I/O_STACK_2 parameter (index 808) is set to “I/O” or the EXTERNAL_INPUT_BUS parameter (Index 809) is **not** set to “Standard”.
		Corrective action: Set BUS/FERN/REMOTE to 0 V (refer to wiring diagram).
		`EMCY STOP ACTIVE`
		The EMERGENCY STOP button has been pressed.
		Corrective action: Acknowledge fault via **Reset** push button in selector switch position LOCAL, or via Foundation Fieldbus parameter APPLICATION_RESET of APVB transducer block (index 784).

Value XD_ERROR	Value XD_ERROR_EXT	Description
17 (0x11) (General error)	0x00000020 (Wrong command)	The actuator is not available for external operation via Foundation Fieldbus. Refer to AUMATIC display, status indication S3 - NOT READY IND. Description of displays: WRONG COMMAND The DOFB has received an operation command “Intermediate position 1 – 8", although the POS_DIRECTRUNNING parameter (index 831) is deactivated. Corrective action: Check operation command and parameter setting.
17 (0x11) (General error)	0x00000100 (Loss of phase)	Loss of one phase. Refer to AUMATIC display, status indication S1 - FAULT IND. Description of displays: LOSS OF PHASE Corrective measure: Check/connect phases. For external supply with 24 V DC, check/connect AUMATIC power supply.
17 (0x11) (General error)	0x00000200 (Thermal fault)	Motor protection has tripped. Refer to AUMATIC display, status indication S1 - FAULT IND. Description of displays: THERMAL FAULT Corrective action: Cool down, wait. If the fault is still displayed after cooling-down: Set selector switch in position **Local control** (LOCAL). Reset fault signal via **Reset** push button or APPLICATION_RESET parameter of APVB (index 784). Check fuse F4. Reduce number of starts and/or check the actual torque requirement of valve.

Affected blocks: APVB APVB.FINAL_POSITION_VALUE.Status = Good_NonCascade/NonSpecific

Value XD_ERROR	Value XD_ERROR_EXT	Description
18 (0x12) (Calibration error)	0x00001000 (No reference operation)	Refer to AUMATIC display, status indication S2 - WARNING Description of displays: INTERNAL FEEDBACK: Position transmitter (potentiometer or RWG) is not standardised. Corrective action: Operate actuator into both end positions (OPEN and CLOSED).

Affected blocks: APVB APVB.FINAL_POSITION_VALUE.Status = Bad/DeviceFailure

Value XD_ERROR	Value XD_ERROR_EXT	Description
20 (0x14) (Electronics Failure)	0x00020000 (Internal electronics error)	Internal fault. Refer to AUMATIC display, diagnostic indication D2 - INTERNAL FAULT Description of displays: TMERMISTOR A failure of the TMS tripping device has been noted. Corrective action: Check wiring diagram and MOTOR PROTECTION(M4108) parameter. Check TMS tripping device. SELECTOR SWITCH Selector switch recognition is defective (no hall sensor or more than one hall sensor actuated). Corrective action: Check local controls board, check mechanical fixture of local controls within the housing. OUTPUT TRANSISTOR Operation command transfer to relay board is defective. Corrective action: check logic board and relay board. I/O1 CAN No communication to parallel interface. Corrective action: The setting of I/O STACK 1 (M4106) parameter must agree with the wiring diagram. check wiring, check parallel interface. PHASE DETECTION Phase detection on power supply board is defective. Corrective action: check phase detection and wiring. 24VDC FAULT The internal 24 V power supply of the AUMATIC is not within the power supply limits. Corrective action: Check power supply, power supply board, and wiring of AUMATIC power supply. LOGIC CAN The logic cannot build up communication. MWG CAN No communication to MWG available. Corrective action: The setting of the CONTROL UNIT (M4109) parameter must agree with the wiring; check wiring, check MWG.

Value XD_ERROR	Value XD_ERROR_EXT	Description
20 (0x14) (Electronics Failure)	0x00040000 (Internal electronics error)	Internal fault. Refer to AUMATIC display, diagnostic indication D2 - INTERNAL FAULT Description of displays: NO REACTION Fault signal of reaction monitoring. Corrective action: Check/set the reaction time (REACTION_TIME parameter, index 820). Check/replace actuator gearbox. Acknowledge fault via **Reset** push button in selector switch position LOCAL, or via Foundation Fieldbus parameter APPLICATION_RESET of APVB transducer block (index 784). LOCAL CONTROL FAULT Hardware fault of the local controls. Corrective action: Replace local controls board

Affected blocks: APVB, ATIB_3 APVB.FINAL_POSITION_VALUE.Status = Bad/DeviceFailure
AITB_3.PRIMARY_VALUE.Status = Bad/SensorFailure

Value XD_ERROR	Value XD_ERROR_EXT	Description
20 (0x14) (Electronics Failure)	0x00010000 (MWG defective)	Refer to AUMATIC display, diagnostic indication D2 - INTERNAL FAULT Description of displays: MWG DEFECTIVE The internal diagnostics of the MWG has detected a fault. Corrective action: Replace/reconfigure MWG. For further details, refer to DQ - INTERNAL FAULT 2 Description of displays: MWG CAN No communication to MWG available. Corrective action: Parameter setting CONTROL UNIT (M4109) must agree with wiring diagram, check wiring, check MWG
20 (0x14) (Electronics Failure)	0x00080000 (Feedback E2 loss)	Refer to AUMATIC display, diagnostic displays D2 - WARNING Description of the displays: FEEDBACK E2 LOSS Signal loss of position transmitter. Corrective action: Check signal and wiring of position transmitter. Check FEEDBACK E2 (M4101) parameter (index 755). The setting must agree with the wiring diagram.

Affected blocks: APVB, AITB_1, AITB_2, DITB_1, DITB_2, DITB_3 APVB.FINAL_POSITION_VALUE.Status = Bad/DeviceFailure
AITB_1(_2).PRIMARY_VALUE.Status = Bad/SensorFailure or ConfigurationError
DITB_1(_2,_3).PRIMARY_VALUE.Status = Bad/SensorFailure or ConfigurationError

Value XD_ERROR	Value XD_ERROR_EXT	Description
19 (0x13) (Configuration error)	0x00002000 (Configuration fault)	Current setting is invalid. Refer to AUMATIC display, diagnostic indication D4 - CONFIGURATION FAULT Description of displays: END POSITION INPUTS The parameter setting LIMIT/TORQUE-SWITCH (M4104) does not agree with the parameter setting END POSITION INPUTS (D0) (can only be changed by AUMA service). NO SWITCHING OFF The parameter setting LIMIT/TORQUE-SWITCH (M4104) does not agree with the parameter configuration CONTROL UNIT (M4109) (can only be changed by AUMA service). E1-IN NOT EXISTING The parameter setting SETPOINT E1 (M4100), index 794) does not agree with the parameter configuration I/O STACK 1 (M4106) (can only be changed by AUMA service).
22 (0x16) (I/O Failure)	0x40000000 (Internal connection to AUMATIC lost)	Internal fault. Refer to AUMATIC display, diagnostic display DQ - INTERNAL FAULT 2 Description of displays: FF CAN No communication to Foundation Fieldbus interface available. Corrective action: I/O STACK 1 (M4106) parameter must agree with wiring diagram. Check wiring.

23 (0x17) (Data Integrity Error)	0x10000000 (EEPROM check failed)	Internal fault. Refer to AUMATIC display, diagnostic display DQ - INTERNAL FAULT 2 Description of displays: EEPROM FAILURE EEprom failure of the logic. Corrective action: Check logic, replace EEprom if required
23 (0x17) (Data Integrity Error)	0x20000000 (RAM check failed)	Refer to AUMATIC display, diagnostic indication DQ - INTERNAL FAULT 2 Description of displays: RAM FAILURE RAM failure of the logic. Corrective action: Replace logic

12. Appendix E: Block operation modes

All blocks express their operation modes via the MODE_BLK parameter. It is a record consisting of four components:
Target, Actual, Permitted, and Normal.

- **Target** is the mode into which the user wants to bring this block. This parameter is writable.
- **Actual** indicates the current block operation mode and can only be read. If the required condition is fulfilled, Target and Actual mode are identical. However, it is possible the Actual and Target mode differ for a definite reason.
- **Permitted** indicates which mode is allowed as Target for this function block.
- **Normal** indicates the normal mode.

The Permitted and Normal modes are writable, however, should not be changed without reason.

Possible operation modes are OOS, IMan, Man, LO, Auto, Cas, Rcas, and ROut:

- **Out_of_Service (OOS)**. This block does not function, the block execution has been interrupted and all output parameter contain the “Bad” status: Out_Of_Service.
- **Initialization Manual (IMan)**. The block is just about to initialise a cascade. This state is used for upstream control blocks to perform a smooth transition to automatic mode.
- **Local Override (LO)**. Fault state or Interlock are active and override the block output value. This is not a valid Target mode but merely a valid actual mode.
- **Manual (Man)**. The block output value is set be the user.
- **Auto (Auto)**. The block output value is set by the block algorithm, whereby the block uses a local value as setpoint.
- **Cascade (Cas)**. The block setpoint is taken out of the CAS_IN parameter which is normally connected to the output of another block. This operation mode can only be used after cascade initialisation. If Cascade shall be used as Target mode, the Auto bit of the Target mode is also set.
- **Remote Cascade (RCas)**. Like for the Cascade mode, the Remote Cascade setpoint is supplied by an external data source. Contrary to Cascade, in Remote Cascade mode the block receives the setpoint from the RCAS_IN parameter which has been written by a host application and not by another function block.
- **Remote Output (ROut)**. The Remote Output mode is identical to the Remote Cascade mode, except that the host application directly sets the block output and not the setpoint. Thus, the setpoint range and the absolute limitation is bypassed for an analogue output block.

Depending on the status of a downstream block or in case of local operation, the Actual mode of function blocks for Output or Control can take the status IMan (Initialization Manual) or LO (Local Override).
Only operation modes OOS and AUTO are available for the resource block.
Only operation modes OOS, MAN, and AUTO are available for transducer blocks.

13. Appendix F: IO_OPTS, availability and description

Bit	Signification	AI	DI	AO	DO	Description
0	Invert		X		X	Indicates whether the discrete input value should be logically inverted before it is stored in the process variable. A discrete value of zero (0) will be considered to be a logical zero(0) and an non-zero discrete value will be considered to be a logical (1). When selecting invert, the PV value is inverted.
1	SP-PV Track in Man			X	X	Allows the setpoint to track the process variable, if the target mode of the block is Man.
2	Reserved				X	
3	SP-PV Track in LO			X	X	Allows the setpoint to track the process variable if the actual mode of the block is LO.
4	SP Track retained target			X	X	Allows the setpoint to track the RCas or Cas parameters based on the retained target mode, if the actual mode of the block is LO or Man. Once SP-PV track options are enabled, the SP track retain target will have precedence in the selection of the value to track if the actual mode is Man and LO.
5	Increase to close			X	X	Defines whether the output value should be inverted before it is communicated to the I/O channel.
6	Fault State to value			X	X	Measures to take in the event of a fault (0: freeze value, 1: accept preset value)
7	Use Fault State value on restart			X	X	Use the FSTATE_VAL(_D) parameter value, other use the non-volatile value. The reaction does not depend on the Fault state function, only the FSTATE_VAL(_D) is used.
8	Target to Man if Fault State activated			X	X	Set target mode to Man when enabling the fault state; the initial target value is lost. This puts the output block in manual mode.
9	Use PV for BKCAL_OUT			x	X	Usually, the BKCAL_OUT value is the active setpoint (SP). This option changes it to the process variable (PV).
10	Low cutoff	x				The AI Low Cutoff algorithm is enabled.
11 – 15	Reserved					

14. Appendix G: CONTROL_OPTS, availability and description

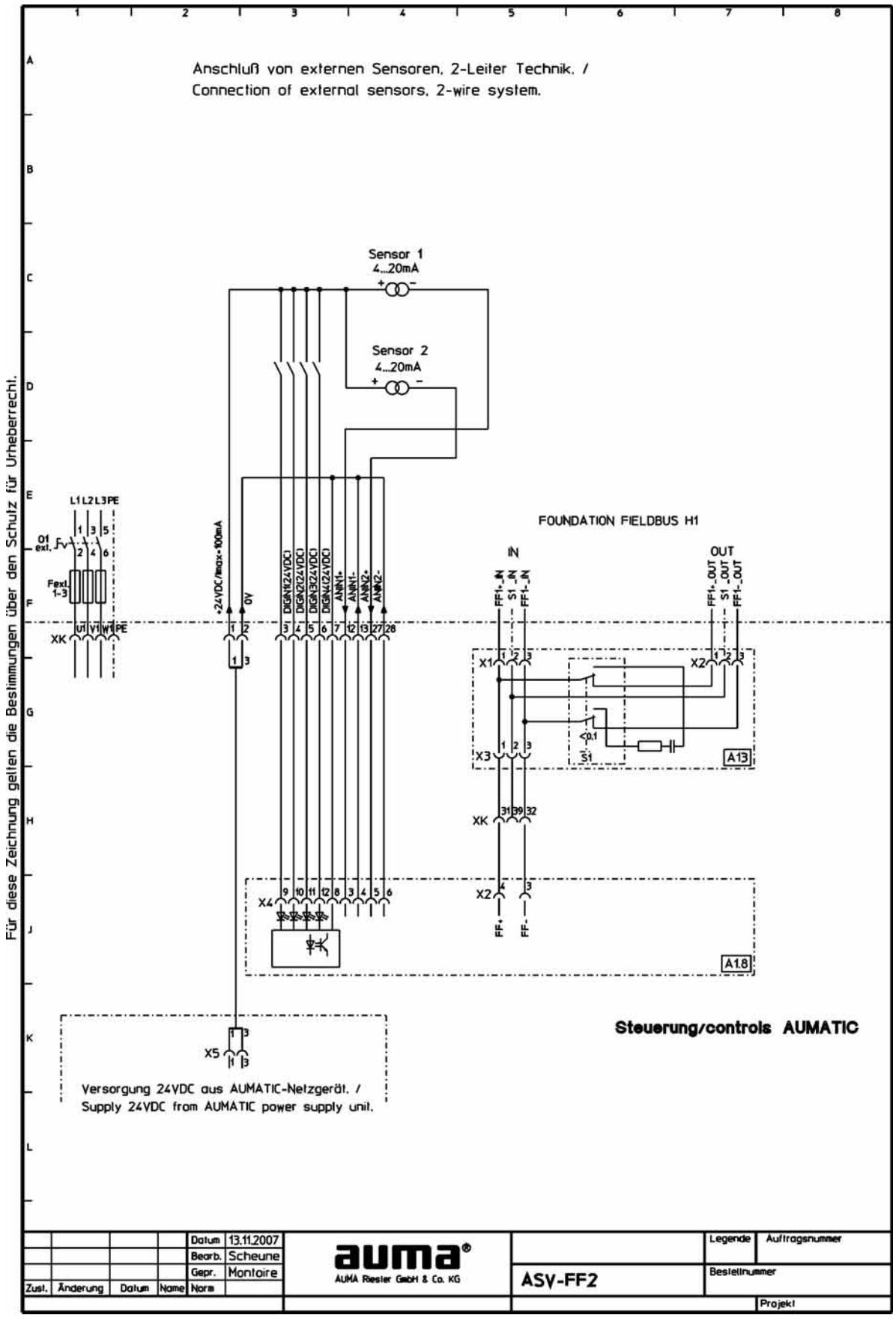
Bit	Signification	PID	Description
0	Bypass Enable	X	This setting can be used to enable the BYPASS function. Some control application cannot provide closed loops if BYPASS is enabled.
1	SP-PV Track in Man	X	Allows the setpoint to track the process variable, if the target mode of the block is MAN.
2	SP-PV Track in Rout	X	Allows the setpoint to track the process variable, if the target mode of the block is ROut.
3	SP-PV Track in LO or IMan	X	Allows the setpoint to track the process variable, if the target mode of the block is LO or IMan.
4	SP Track retained target	X	Allows the setpoint to track the RCas or Cas parameters based on the retained target mode, if the actual mode of the block is IMan, LO, Man, or Rout. If the SP-PV track options are enabled, the SP track retain target will have precedence in the selection of the value to track if the actual mode is Man, IMan, Rout, or LO.
5	Direct Acting	X	Defined the relationship between a change in the process variable and the respective output change. If Direct has been selected, a process variable increase results in an output increase
6	Reserved		
7	Track Enable	X	This enables the external tracking function. When enabled, the value in TRK_VAL replaces the OUT value if TRK_IN_D is set and the target mode is not Man.
8	Track in Manual	X	When enabled, the TRK_VAL value replaces the OUT value if TRK_IN_D is set. this allows TRK_VAL to replace the OUT value if the target mode is Man and TRK_IN_D applies. The actual mode is then LO.
9	Use PV for BKCAL_OUT	X	The BKCAL_OUT and RCAS_OUT values are normally the active setpoints (SP). This option changes it into the process variable (PV) if the control cascade is closed.
10	Act on IR		If enabled, the setpoint is adapted within the setpoint limits after receipt of IR on the BKCAL_IN, and when closing the control cascade, a bumpless transfer is guaranteed. If the setpoint required to provide a bumpless transfer is outside the setpoint limits, any adaptation to ensure bumpless transfer will be removed again within the BAL_TIME.
11	Use BKCAL_OUT with IN_1		Normally, BKCAL_OUT is used to initialise a downstream block providing CAS_IN. When this option is enabled, BKCAL_OUT is used for a downstream block providing IN_1. This option can be used in combination with the ratio and the bias/gain block to determine value and status, which must be made available in BKCAL_OUT for correct initialisation and for handshake..
12	Obey SP limits if Cas or RCas	X	Normally, the setpoint is not limited to the setpoint limit, except it is entered by a user. When this option is selected, the setpoint is subject to the absolute setpoint limits in Cas and RCas.
13	No OUT limits in Manual	X	OUT_HI_LIM or OUT_LO_LIM are not considered, if the target and actual modes are set to Man.
14+15	Reserved		

15. Appendix H: STATUS_OPTS, availability and description

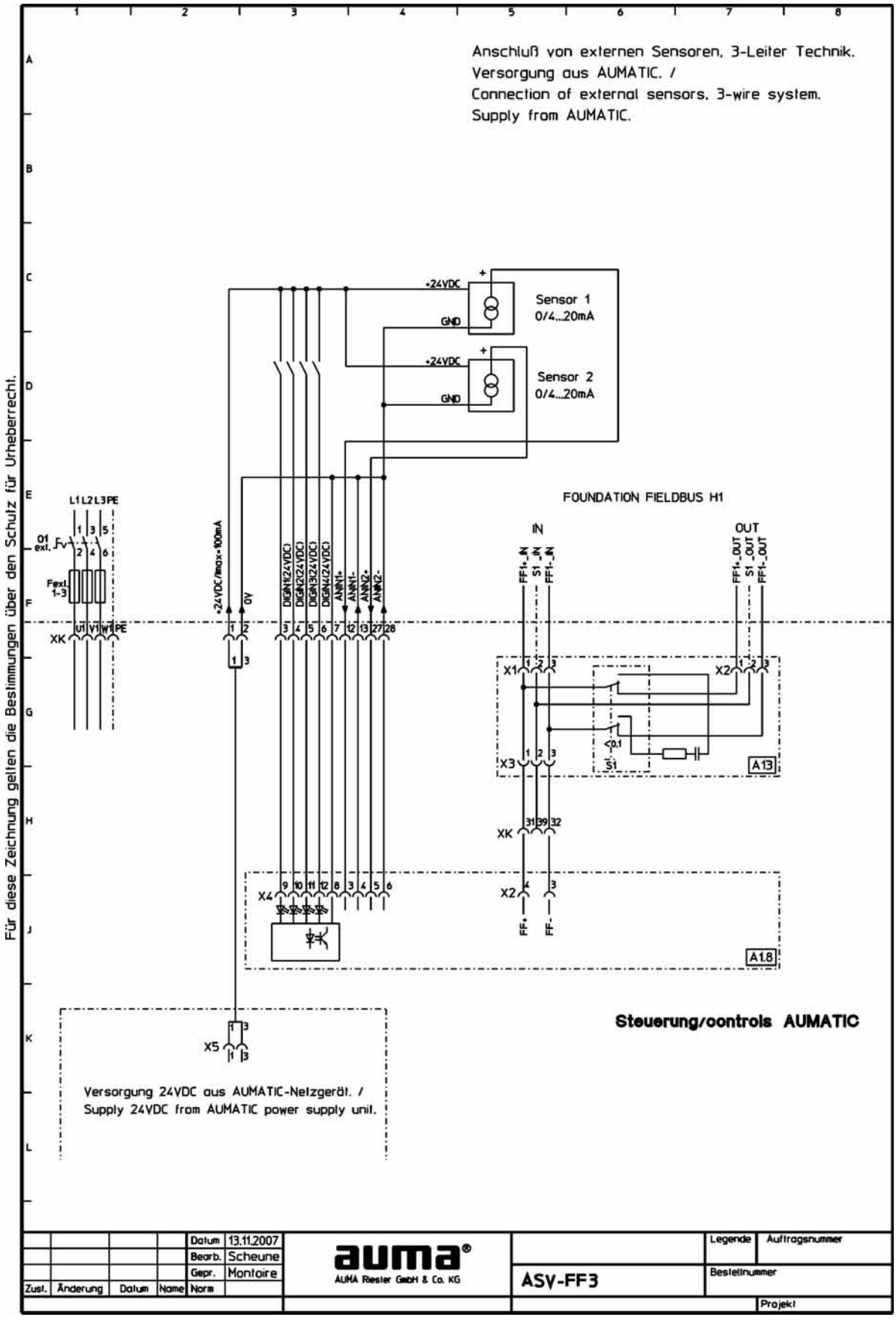
Bit	Signification	AI	DI	AO	DO	PID	Description
0	IFS if BAD IN					X	Activate initiate fault state status in OUT parameter if the IN parameter status is BAD.
1	IFS if BAD CAS_IN					X	Activate initiate fault state status in OUT parameter if the CAS_IN parameter status is Bad.
2	Use Uncertain as Good					X	If the IN parameter status is Uncertain, treat as if it were Good. Otherwise, treat is as Bad.
3	Propagate Fault Forward	X	X				If the sensor status is Bad, Device failure, Bad, or Sensor failure, transmit this status without issuing an alarm to the OUT parameter. This option allows the user to determine whether the alarm (sending an alert) is carried out by the block or transmitted to upstream blocks for alarm issue.
4	Propagate Fault Backward			X	X		If the status set by the actuator is Bad, Device failure, Fault State Active or Local Override Active, transmit this status as Bad, Device Failure or Good Cascade, Fault State Active or Local Override to BKCAL_OUT without generating an alarm. This option allows the user to determine whether the alarm (sending an alert) is carried out by the block or transmitted to an upstream block for alarm issue.
5	Target to Manual if BAD IN					X	Set target mode to Man, if the status of the IN parameter is Bad. This causes the switching of a PID block in Man status if the input should go to Bad.
6	Uncertain if Limited	X					Set the output status of an input or calculation block to Uncertain if the measured or calculated value is subject to a limit.
7	BAD if Limited	X					Set the output status to Bad if the sensor is at a High or Low Limit. Reference: Bad (if Limited) has preference before Uncertain (if Limited).
8	Uncertain if Man mode	X	X				Set the output status of an input or calculation block to Uncertain if the actual mode of the block is Man.
9	Target to next permitted mode if BAD CAS_IN						Set target mode to the next permitted mode if the target mode is CAS and the status of CAS_IN is Bad. This switches a control block within the next permitted mode, if CAS_IN is used for control and if the status changes to Bad.
10+15	Reserved						

16. Appendix I: Proposed wiring diagrams

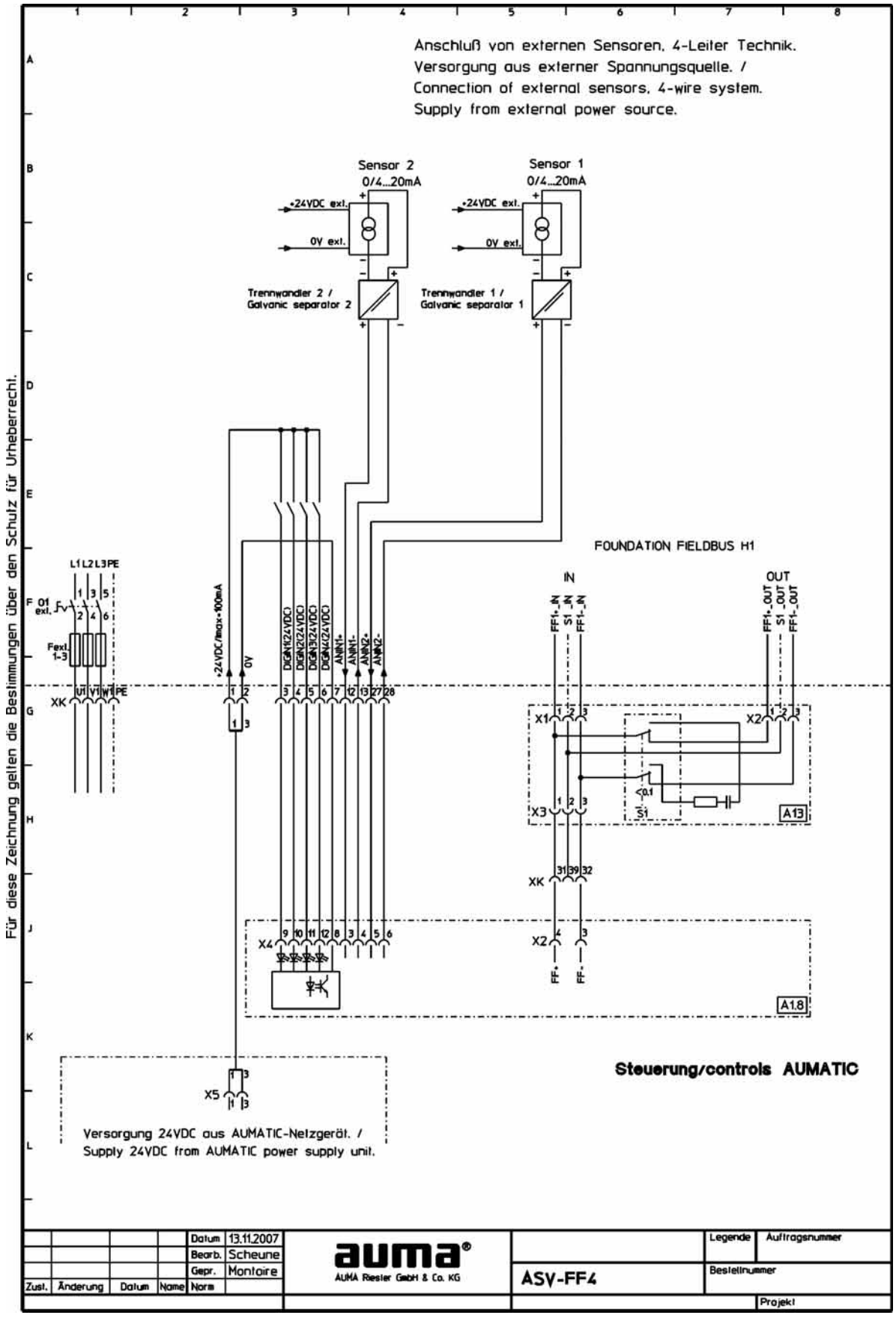
16.1. Connecting external sensors, 2-wire technology



16.2. Connecting external sensors, 3-wire technology



16.3. Connecting external sensors, 4-wire technology



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