SIEMENS

SITRANS

Process monitoring SITRANS DA400 for Feluwa hose diaphragm piston pumps

Operating Instructions

07/2008
A5E00429572-03

Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠CAUTION

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

⚠WARNING

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Trademarks

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Ordernumber: A5E00429572
℗ 07/2008

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Introduction 1

1.1 Purpose of this Documentation

These instructions include all the information that you will need for starting up and using the SITRANS DA acoustic diagnostics setup.

It is aimed both at persons mechanically installing the device, connecting it electronically, configuring the parameters and putting it into operation, and at service and maintenance engineers.

1.2 Further information

Information

The contents of this programming manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. All obligations on the part of Siemens AG are contained in the respective sales contract, which also contains the complete and solely applicable warranty conditions. Any statements on the device versions described in the programming manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of printing. We reserve the right to make technical changes in the course of further development.

Contact person worldwide

If you need more information or have particular problems that are not covered sufficiently by this programming manual, please contact your contact person. You can find your regional contact person on the Internet.

Product information on the Internet

The programming manual is an integral part of the CD, which is either supplied or can be ordered. The programming manual is also available on the Siemens homepage.

On the CD, you will also find the specification sheet with the ordering data, the Software Device Install for SIMATIC PDM for additional installation, and the required software.

See also

Contacts (http://www.siemens.com/processinstrumentation/contacts)

Product information on SITRANS DA in the Internet (http://www.siemens.com/sitransda)

Instructions and Manuals (http://www.siemens.com/processinstrumentation/documentation)

1.3 CE label

This device meets the requirement of EU guidelines:

- 89/336/EEC Guideline of the Council on Aligning Legal Regulations of Member States on Electromagnetic Compatibility (EMV). Revised by
  - 91/263/EEC
  - 92/31/EEC
  - 93/68/EEC
- 94/9/EC Guideline of the European Parliament and the Council on Aligning Legal Regulations of the Member States on Devices and Protective Systems for defined use in areas subject to explosion.

This is communicated by the CE label.

CE 0032

D-76181 Karlsruhe

General safety instructions

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2.1 General information

This device left the factory free from safety problems. In order to maintain this status and to ensure safe operation of the device, please observe the safety information and warnings contained in these instructions.

2.2 Correct usage

The device may only be used for the purposes specified in these instructions.

Insofar as they are not expressly stated in these instructions, all changes to the device are the sole responsibility of the user.

2.3 Laws and directives

The regulations of the test certification valid in your country are to be observed.

Electrical connection in hazardous zones with explosive atmospheres

The national directives and laws for hazardous areas valid in your country must be observed for electrical connection. Examples of these as found in Germany:

- Working reliability regulation
- Directive for the installation of electrical systems in hazardous areas DIN EN 60079-14 (previously VDE 0165, T1)

2.4 Measures

For the sake of safety, the following precautions must be observed:

⚠ WARNING

"Intrinsically safe" protection type

"Intrinsically-safe" devices lose their certification as soon as they are operated on circuits which do not correspond with the test certification valid in their country. The protection level "ia" of the device is reduced to protection level "ib" if intrinsically safe circuits with protection level "ib" are connected.

Protection type "limited energy" nL (zone 2)

Devices with "limited energy" may be connected and disconnected while in operation.

Protection type "non-sparking" nA (zone 2)

Devices with "non-sparking" protection may only be connected and disconnected when off circuit.

⚠ CAUTION

Electrostatic Sensitive Devices (ESD)

This device contains electrostatic sensitive devices. Electrostatic sensitive devices may be destroyed by voltages that are undetectable to a human. Voltages of this kind occur as soon as a component or an assembly is touched by a person who is not grounded against static electricity. The damage to a module as a result of overvoltage cannot usually be detected immediately. It may only become apparent after a long period of operation.

2.5 Qualified Personnel

"Qualified personnel" means those who are familiar with the installation, mounting, commissioning and operation of the product. They must have the following, appropriate qualifications for their activities:

- Training or instruction/authorization in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures and aggressive as well as hazardous media.
- For explosion-proof devices: Training or instruction/authorization in carrying out work on electrical circuits for hazardous systems.
- Training and instruction in maintenance and use of adequate safety equipment according to safety regulations.
- Should be trained in first aid.

Description

3

3.1 Applications

The SITRANS DA400 acoustic diagnostics unit acoustically measures the acoustic emission of oscillating positive displacement pumps.

The SITRANS DA400 allows continuous, simultaneous and independent monitoring of up to four valves in a pump for leaks. In addition, another four inputs are available for monitoring standard signals (e.g. diaphragm and temperature monitoring). This means that the condition of an oscillating positive displacement pump is monitored in every phase of its operation.

The SITRANS DA400 is used in all industries where oscillating positive displacement pumps are used.

3.2 Operation

You can operate and configure the SITRANS DA400 using the keys. In parallel, you can also operate the SITRANS DA400 via a PROFIBUS connection.

3.3 Layout

3.3.1 Device structure

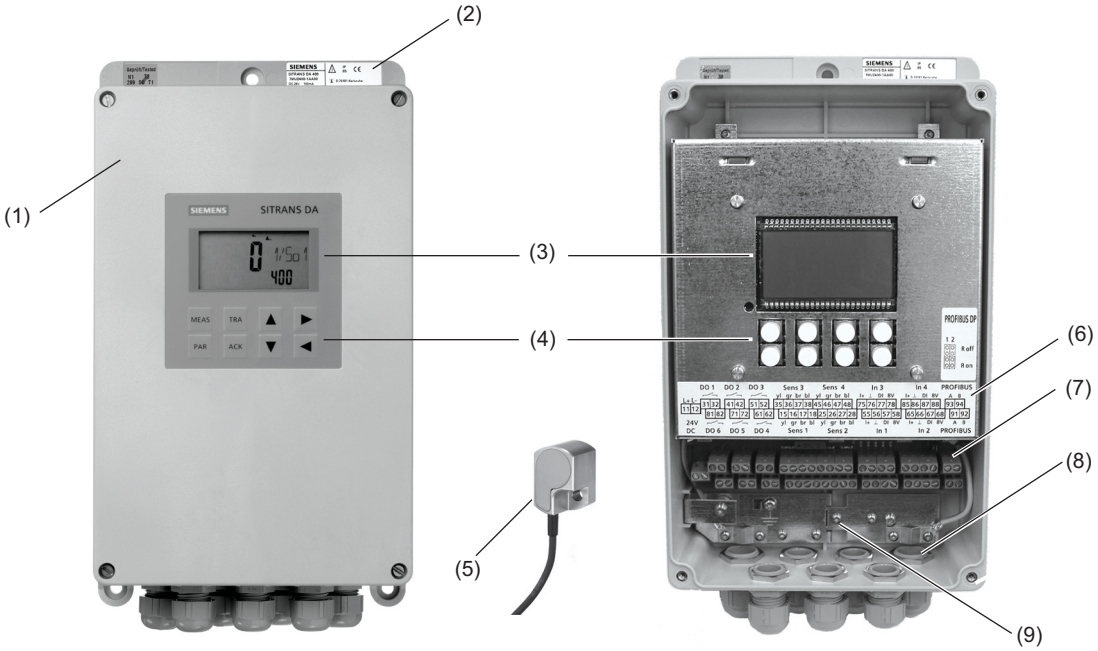

Figure 3-1 Front view (closed and open)

(1) Unscrewable cover
(2) Name plate
(3) Digital display
(4) Keypad
(5) Sensor
(6) Terminal connection diagram
(7) Terminal block
(8) Cable gland
(9) Mounting plate

3.3.2 Structure of the nameplate

Device

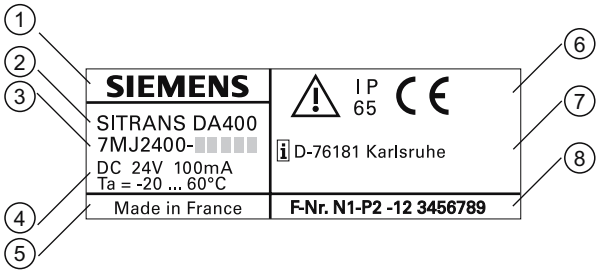

Figure 3-2 Device type plate

①	Manufacturer	⑤	Place of manufacture
②	Product name	⑥	Product information
③	Order no.	⑦	Information address
④	Technical data	⑧	Serial number

Sensor

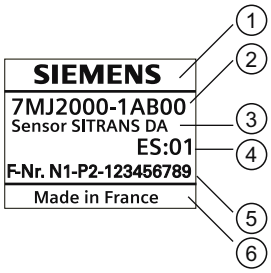

Figure 3-3 Sensor type plate

①	Manufacturer	④	Product version
②	Order no.	⑤	Serial number
③	Product name	⑥	Place of manufacture

3.4 Mode of operation

3.4.1 Measuring principle

Leaks in the delivery valves of oscillating displacement pumps are flows in which cavitation occurs. This results in sound waves that are transmitted to the valve housing, where they are recorded by the structure-borne sound sensor in the SITRANS DA400 on the outside.

The SITRANS DA400 utilizes the fact that with both an open valve and a closed intact valve, no cavitation occurs and the measured sound level thus corresponds to the operating noise of the pump. By contrast, with a closed defective valve cavitation does occur, which can be identified by a period increase in the sound level (see figures). The measured value from the SITRANS DA400 corresponds exactly to this increase in the sound level.

The measurement is carried out exclusively in the ultrasonic range. This filters out the operating noise of the pump and the closing noise of the valves.

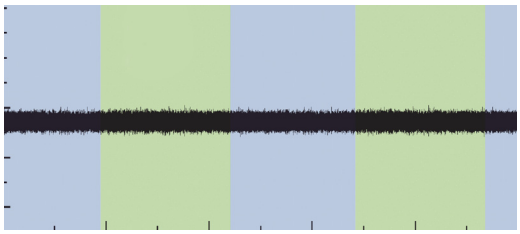

Figure 3-4 Signal from structure-borne sound sensor with intact valve

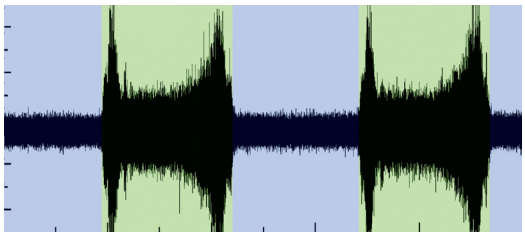

Figure 3-5 Signal from structure-borne sound sensor with defective valve

3.4.2 Sensor operation

The acoustic emission sensor works on the piezoelectric principle. The acoustic emission is injected into the sensor via the sensor base (mounting surface) and inside it is converted into an electrical voltage by a piezoceramic element. This is amplified in the sensor and transmitted via the cable.

The sensor frequency range lies in the ultrasonic range (>20 kHz). The sensor is non-directional, i.e. the angle at which the sound wave is incident on the sensor base is not important.

3.4.3 Operation of the electronics

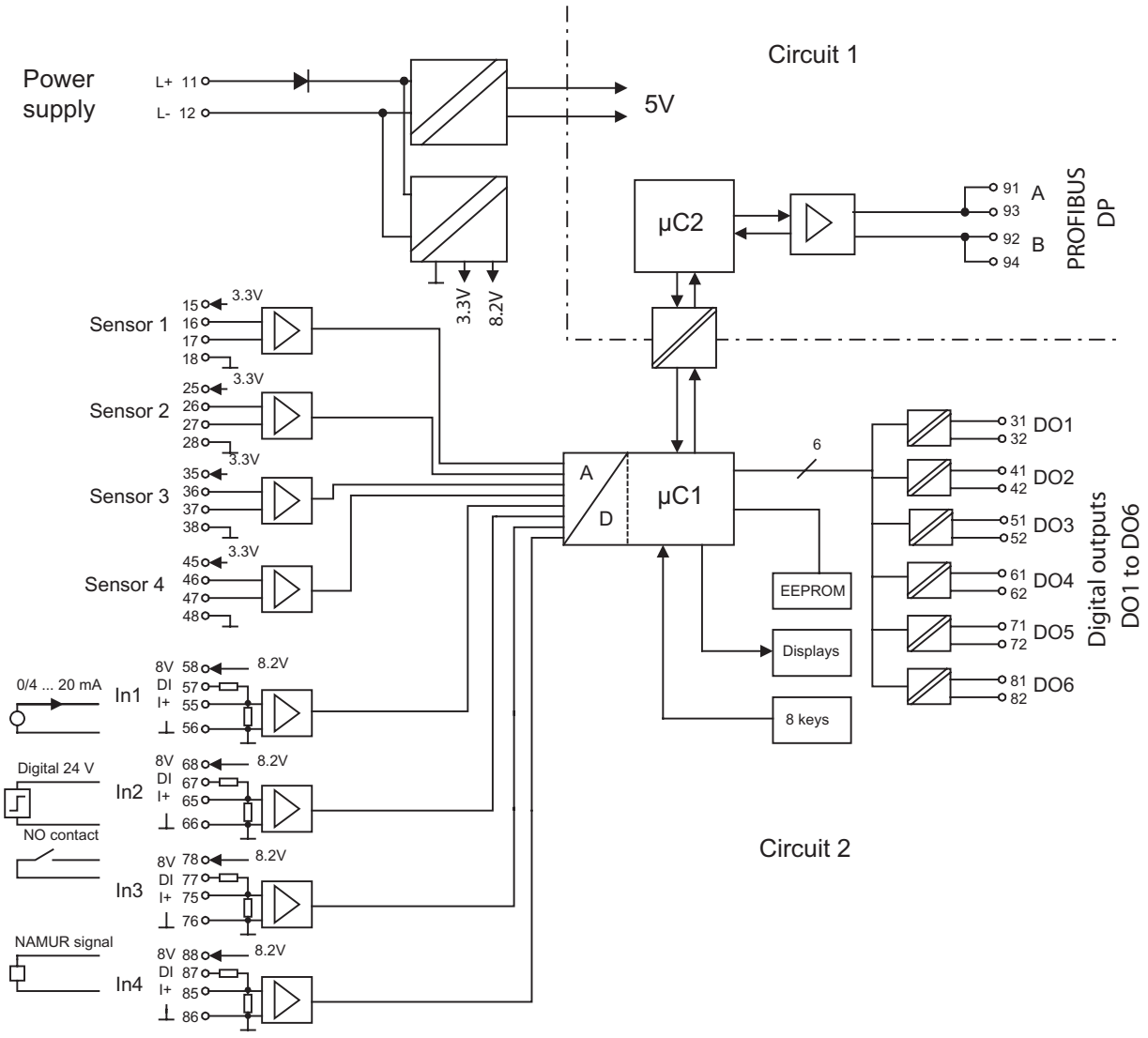

Figure 3-6 Block diagram

L+	Power supply +	I+	Analog current input +
L-	Power supply -	⊥	Mass
DO	Digital output	DI	Digital input
Sens	Sensor	A	PROFIBUS DP Signal A (green)
In	Universal input	B	PROFIBUS DP Signal B (red)

The 24 V DC power supply uses a polarity reversal protection diode to supply the internal supply voltage of 5 V for circuit 1 and 3.3 V and 8.2 V for circuit 2. Circuits 1 and 2 are isolated from the power supply and from one another. Circuit 1 consists of a microcontroller (µC2), which is responsible for PROFIBUS communication. It is connected to the microcontroller (µC1) in circuit 2 by a serial, isolated coupling. At the heart of this circuit is a

signal processor with integrated analog-to-digital converter for high-speed recording and evaluation of the available signals. Furthermore, an EEPROM for storage of data even in the case of power failure and the display are actuated and the buttons are read in.

The six digital outputs are individually isolated and act as normally open contacts, i.e. they are either low resistance or high resistance. The maximum of four acoustic emission sensors are connected to the four-pole "Sens1" to "Sens4" blocks. In each case, two terminals provide the supply for the sensor electronics and two terminals are used to connect the sensor signal.

Different standard signals can be connected at each of the four universal inputs "In 1" to "In 4". The wiring of the four terminals must be adapted depending on the signal or sensor type (0/4 to 20 mA, digital signal 24 V, normally open contact, NAMUR proximity sensor).

Installation

4

4.1 Safety information for installation

Ambient temperature

⚠ WARNING

Fire hazard

Fire hazard resulting from hot surfaces. When installing the sensor, take note of the surface temperature of the installation site.

Overview

The SITRANS DA400 and the sensor are mounted in different ways. In general:

Note

Protection against harmful outside influences

To protect the SITRANS DA400 against harmful outside influences, a housing should be fitted. Harmful external influences can occur if you install the SITRANS DA in the open air, where it can be influenced by intensive frost, heat or rain.

4.2 Mounting

Mounting the device

To mount the device, you need three screws with a diameter of 6 mm. These are not supplied with the device.

The position of the mounting holes and the mounting dimensions in millimeters are indicated on the rear of the housing.

The device should preferably be mounted vertically with the cable gland pointing downwards.

Mounting the sensor

Each acoustic emission sensor should be individually mounted on the outside of the pump or valve housing, close to the valve to be monitored, using the enclosed M6x16 hexagon socket-head screw and positioning pin ∅ 3x10.

There is a good acoustic coupling if no elastic elements such as seals or similar are located between the sensor and the valve, i.e. there are good ferrous connections.

As the acoustic emission is injected into the sensors via their base, the substrate on the housing must be uniformly even and smooth, and at least as large as the sensor base. To improve the coupling, in certain circumstances a viscous lubricant can be used (not in the scope of delivery).

Note

Mounting the sensor

On pumps that have good acoustic coupling between the discharge and suction side, it can be sufficient to use just one sensor for a pump head (with two valves). However, in this case it is not possible to distinguish which valve has a leak.

The acoustic emission sensors are mounted at an equal spacing to the valves.

Connecting

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5.1 General information and procedures

Safety notes

⚠ WARNING

To ensure safe operation of this device, it must be properly installed and commissioned by qualified personnel in adherence to the warning notices. This includes both the general safety regulations for working on high voltage systems (e.g. DIN VDE) and the regulations relating to proper use of tools and the use of personal protective equipment (goggles, protective gloves etc.).

Caution - the power supply is to be shut off before opening the device. Non-compliance can result in death, severe physical injury and/or significant damage.

Note

All connecting leads inside the device should be kept short.

To ensure the degree of protection according to IP65 for the device, only the permissible cable diameters may be used.

Required tools

You will need the following screwdrivers:

- To open the housing: Screwdriver for M4 slotted screws
- For connecting terminals: Screwdriver for M2.5 slotted screws
- Shielding connections: T10 screwdriver for M3 torx-slotted screws
- Earthing: T20 screwdriver for M4 torx-slotted screws

5.2 Terminal assignment

Terminal connection diagram

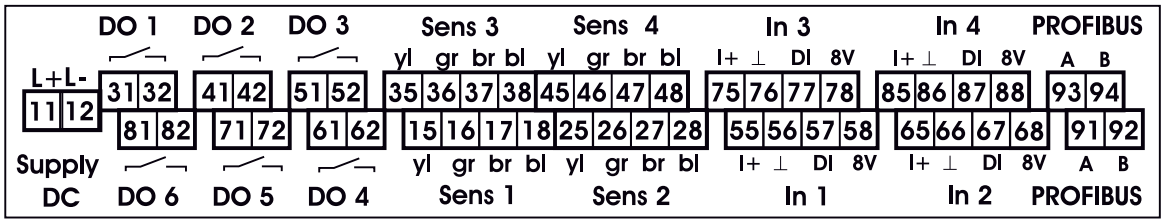


Figure 5-1 Terminal connection diagram

L+	Power supply +	br	Brown
L-	Power supply -	bl	Black
DO	Digital output	I+	Analog current input +
Sens	Sensor	⊥	Mass
In	Universal input	DI	Digital input
yl	Yellow	A	PROFIBUS DP Signal A (green)
gr	Green	B	PROFIBUS DP Signal B (red)

5.3 Cable gland

General procedure

The leads are generally connected as follows:

1. Unscrew the cover and place it next to the device.
2. Loosen the cable gland.
3. Remove the sealing stopper.
4. Connect the desired lead.
5. Tighten the cable gland.

Arrangement of cable glands

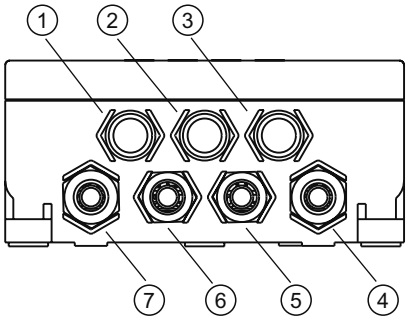


Figure 5-2 Arrangement of cable gland

① Cable gland for digital outputs "DO 1" to "DO 6"
② Cable gland for signal inputs "In 1" and "In 3"
③ Cable gland for signal inputs "In 2" and "In 4"
④ Cable gland for PROFIBUS
⑤ Cable gland for sensors 2 and 4
⑥ Cable gland for sensors 1 and 3
⑦ Cable gland for power supply L+ and L- and earthing

5.4 Connecting the sensors

Procedure

The procedure for connecting the sensors is as follows:

1. Select the corresponding cable gland:
   Sensor 1 and 3 through cable gland ⑥
   Sensor 2 and 4 through cable gland ⑤
2. Completely loosen one screw on the mounting plate (Torx T10).
3. Use this screw to attach the cable lug for the shielding connection.
4. Connect the four lines to a four-way block, "Sens1" to "Sens4".
   Observe the color scheme.

Cable color	Terminal symbol	Sensor 1	Sensor 2	Sensor 3	Sensor 4
Yellow	yl	15	25	35	45
Green	gr	16	26	36	46
Brown	br	17	27	37	47
Black	bl	18	28	38	48

5.5 Connecting digital outputs

Procedure

For up to six digital outputs, it is recommended that you use a 12-wire cable, which is fed through a cable gland ①.

5.6 Connecting signal inputs

General information

- The cable glands ② and ③ , each with two openings, are available for up to four signal inputs "In 1" to "In 4".
- Cable gland ② should be used for signal inputs "In 1" and "In 3".
- Cable gland ③ should be used for signal inputs "In 2" and "In 4".
- When wiring several signal sources (analog current and 24 V digital signal), it must be ensured that the four inputs relate to a common internal mass. Terminals 56, 66, 76 and 86 (if used) should therefore lead to a central star point in the system.

Connecting the analog current 0/4 to 20 mA

Connect the analog current line in accordance with the following table:

Current signal	Terminal symbol	In 1	In 2	In 3	In 4
I+	I+	55	65	75	85
I-	⊥	56	66	76	86

Connecting the 24 V digital signal

Connect the signal line in accordance with the following table:

Digital signal	Terminal symbol	In 1	In 2	In 3	In 4
+	DI	57	67	77	87
-	⊥	56	66	76	86

Connecting the digital signal in line with NAMUR

NOTICE
Polarity The signal sensor is supplied from the 8.2 V source and the current produced is measured. Correct polarity must be ensured.

Connect your signal in accordance with the following table:

Digital signal	Terminal symbol	In 1	In 2	In 3	In 4
+	8V	58	68	78	88
-	I+	55	65	75	85

Connecting the passive normally open contact

Note

Polarity

A normally open contact switches the 8.2 V signal to the digital input. A particular polarity is not necessary.

Connect your signal in accordance with the following table:

Digital signal	Terminal symbol	In 1	In 2	In 3	In 4
Contact 1	8V	58	68	78	88
Contact 2	DI	57	67	77	87

See also

Cable gland (Page 21)

5.7 Connecting PROFIBUS DP

Condition

NOTICE
Bus cable Use only certified bus cables for PROFIBUS DP (e.g. 6XV1830-0EH10).

Procedure

The procedure for connecting PROFIBUS DP is as follows:

1. Strip the bus cable as shown in the figure below.
2. Loosen the right-hand cable clamp.
3. Pass the bus cable through the cable gland ④.
4. Attach the cable shield to the cable clamp and reconnect the earth cable.
5. Connect the green wire to terminal 91 and the red wire to terminal 92.

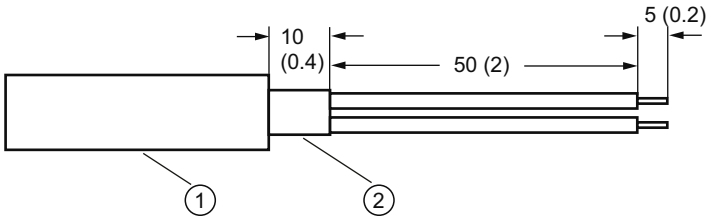


Figure 5-3 PROFIBUS cable, dimensions in mm (inches)

① Bus cable
② Cable shield

Note

If the device is the last in a PROFIBUS stream, set both coding bridges to "Ron" position, otherwise to "Roff" position.

See also

Cable gland (Page 21)

5.8 Connecting the power supply

Procedure

The procedure for connecting the power supply is as follows:

1. Pass the connecting leads L+, L- and the earth cable through the cable gland ⑦.
2. Connect L+ to terminal 11 and L- to terminal 12.
3. Connect the earth cable to the earthing clamp on the mounting plate.

Note

Electromagnetic Compatibility

To guarantee high EMC interference immunity, the earth cable should be kept as short as possible.

In addition, a compensating line with as large a cross-section as possible is strongly recommended between the sensors and the earthing point.

See also

Cable gland (Page 21)

Operation

6

6.1 Overview of operation

The following sections provide information about the digital display, the control panel with keys and the modes. You will learn how you can display measured values and change the parameters.

If there are references to further information on an aspect described here, these will always be found at the end of a chapter under "See also"'

Digital display and keys

You can use the control panel and keys to set all modes.

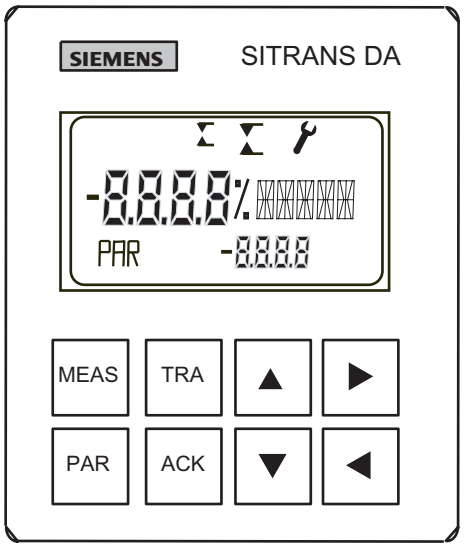


Figure 6-1 Digital display and keys

Meaning of keys

<MEAS>	Measuring: return to measuring menu
<PAR>	Parameters: call up the parameter menu
<TRA>	Trace: call up the trace menu to display and reset various timers
<ACK>	Acknowledge
	In the measurement menu: Acknowledge an alarm that has been set off
	In the trace menu: Reset timers
▲	Increases the value of the selected parameter
▼	Decreases the value of the selected parameter
▶	Scroll forwards in measuring channel list, parameter list and trace list
◀	Scroll backwards in measuring channel list, parameter list and trace list

6.2 Digital display

Introduction

The following sections give an overview of the elements that appear in the digital display.

Layout

Pressing the <MEAS> key in the measuring menu activates a test of the digital display, see the following figure:

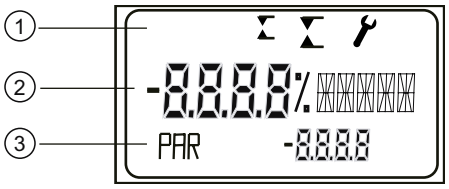


Figure 6-2 Digital display

① Upper section
② Middle section
③ Lower section

Description

In the upper section ① of the digital display, alarm messages are displayed using symbols:

- Pre-alarm
- Main alarm
- Summation alarm

Depending on the menu selected, the digital display in the middle section ② shows the following:

- Measured value or fault signal, parameter value, timer value (trace)
- Channel number, parameter name, timer name (trace)

Depending on the menu selected, the digital display in the lower section ③ shows the following:

- PAR only in the parameter menu
- Value of the main alarm or limit value, parameter number, unit of time in the trace menu.

6.3 Measuring menu

6.3.1 Overview

Introduction

Once you have turned on the power supply, the device automatically switches to the measuring menu. You can return to this menu from any other menu by pressing the <MEAS> key. The following functions are available:

- Select measuring channel
- Display measured value (in dB)
- Acknowledge the alarms coming from the acoustic channels.
- Switch to parameter menu or trace menu

Note

Measuring canals configured with "oFF" are not displayed. This is set using parameters P.1 to P.4 and P.26 to P.29. If all channels are "oFF", the message "oFF/ALL" appears in the digital display.

Procedure

Use the ◀ or ▶ keys to set the desired channel. The set acoustic channel is then shown in the middle section of the digital display.

6.3.2 Acoustic channels

Introduction

There are four channels for connection of acoustic emission sensors. They are shown as follows in the digital display:

- 1/So1
- 2/So2
- 3/So3
- 4/So4

Elements of the digital display

The figure below shows you which elements can appear in the digital display.

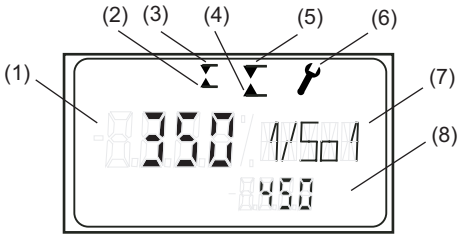


Figure 6-3 Measuring menu digital display, acoustic channel

(1)	The measurement value blinks when a major alarm is received (starting with software version 1.03).	(5)	Main alarm received
(2)	Pre-alarm not received	(6)	Summation alarm received
(3)	Pre-alarm received	(7)	Channel number
(4)	Main alarm not received	(8)	Associated main alarm value

Summation alarm

The summation alarm is the OR of all received main alarms. There is one main alarm per channel. If the main alarm is exceeded, the measured value display flashes.

Sensor fault

If the acoustic channel has a fault, the following appears in the digital display:

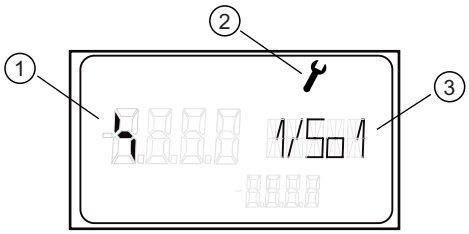


Figure 6-4 Measuring menu digital display, acoustic channel fault

(1) Symbol for sensor fault
(2) Summation alarm, received from other acoustic channels
(3) Channel number
(4) The associated value of a major alarm; indicated starting with software version 1.03.

Acknowledging alarms

Received alarms from the selected channel are acknowledged using the <ACK> key, i.e. the alarm is reset.

Condition: P.14/AcK = "¬St.Ac" or "St.Ac"

The following can appear in the digital display as soon as you press the <ACK> key:

Pre-alarm or main alarm received:	rES (flashing)
No alarm received:	noAL

Note

The alarms are reset after 5 seconds. If you release the <ACK> key within these 5 seconds, the alarms are not reset.

6.3.3 Analog input

Introduction

Monitor the analog and digital signals for limit values using the four universal inputs. You can use an external transducer with the following analog output signals:

- Analog signal 0-20 mA
- Analog signal 4-20 mA

Condition

- The measuring must be parameterized as an analog input. The measuring channel is parameterized as an analog input if the measuring channel parameter P.26 to P.29 is set at the value "0-20", "4-20", "20-0" or "20-4".

Digital display elements on analog inputs

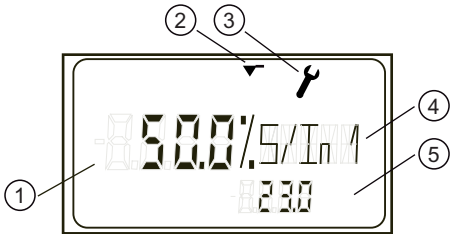


Figure 6-5 Measuring menu digital display, analog input

① Standardized measured value; flashes, when alarm received. Selected measuring range with parameter 26 to 29 is standardized from 0 to 100 %.

② Limit value exceeded

③ Summation alarm received from acoustic channels

④ Number and name of measuring channel

⑤ Associated limit value (here, parameter "P.30/AL I1")

6.4 Parameter menu

6.4.1 Parameter table

Parameter no.	Parameter name	Adjustment/display range	Factory setting	Comment
P. 0	SWREV	1.00		SW version (not adjustable)
P. 1	SoCH1	oFF, on L, on H	oFF	Acoustic channel 1 on L: Substitute value 0 for sensor fault on H: Substitute value 10000 for sensor fault
P. 2	SoCH2	oFF, on L, on H	oFF	Acoustic channel 2 / See P.1
P. 3	SoCH3	oFF, on L, on H	oFF	Acoustic channel 3 / See P.1
P. 4	SoCH4	oFF, on L, on H	oFF	Acoustic channel 4 / See P.1
P. 5	PrAL1	0 to 9999	9999	Pre-alarm channel 1
P. 6	AL1	0 to 9999	9999	Main alarm channel 1
P. 7	PrAL2	0 to 9999	9999	Pre-alarm channel 2
P. 8	AL2	0 to 9999	9999	Main alarm channel 2
P. 9	PrAL3	0 to 9999	9999	Pre-alarm channel 3
P.10	AL3	0 to 9999	9999	Main alarm channel 3
P.11	PrAL4	0 to 9999	9999	Pre-alarm channel 4
P.12	AL4	0 to 9999	9999	Main alarm channel 4
P.13	TIME	0 to 1000	0	Response time for alarms coming from acoustic channels in seconds
P.14	AcK	oFF, ¬St.Ac, St.Ac	oFF	Type of alarm acknowledgement: oFF: Alarm not stored, no acknowledgement ¬St.Ac: Alarm not stored, acknowledgement stops until next response St.Ac: Alarm stored, acknowledgement stops until next response
P.15	doPR1	oFF, do1, do2, do3, do4, do5, do6, ¬do1, ¬do2, ¬do3, ¬d04, ¬do5, ¬do6	oFF	Status signal assignment: Pre-alarm 1 to hardware output (do : digital output / ¬ : inverse)
P.16	doAL1	As P.15	do1	Main alarm 1
P.17	doPR2	As P.15	oFF	Pre-alarm 2
P.18	doAL2	As P.15	do2	Main alarm 2
P.19	doPR3	As P.15	oFF	Pre-alarm 3
P.20	doAL3	As P.15	do3	Main alarm 3
P.21	doPR4	As P.15	oFF	Pre-alarm 4
P.22	doAL4	As P.15	do4	Main alarm 4
P.23	doFAI	As P.15	oFF	Input fault summation signal
P.24	doFAu	As P.15	oFF	Internal fault summation signal
P.25	P ouT	PoS / inv	PoS	Output polarity

Parameter no.	Parameter name	Adjustment/display range	Factory setting	Comment
P.26	INP1			Function of universal input 1:
		OFF	oFF	No function
		24v		24 V digital signal >7 V -> high
		¬24V		¬24 V digital signal <4.5 V -> high
		nAM		Namur digital signal >2.1 mA -> high
		¬nAM		¬Namur digital signal <1.1 mA -> high
		0-20		Analog signal 0 to 20 mA ->0 to 100 %
		4-20		Analog signal 4 to 20 mA ->0 to 100 %
		20-0		Analog signal 20 to 0 mA ->0 to 100 %
		20-4		Analog signal 20 to 4 mA ->0 to 100 %
		noPA		Parameter lock
P.27	INP2	As P.26		Function of universal input 2
P.28	INP3	As P.26		Function of universal input 3
P.29	INP4	As P.26		Function of universal input 4
P.30	AL I1	-5.0% to 105.0%	105.0%	Universal input 1 alarm (analog current function only)
P.31	AL I2	-5.0% to 105.0%	105.0%	Universal input 2 alarm (analog current function only)
P.32	AL I3	-5.0% to 105.0%	105.0%	Universal input 3 alarm (analog current function only)
P.33	AL I4	-5.0% to 105.0%	105.0%	Universal input 4 alarm (analog current function only)
P.34	do I1	oFF, do1, do2, do3, do4, do5, do6, ¬do1, ¬do2, ¬do3, ¬d04, ¬do5, ¬do6	oFF	Status signal assignment Universal input 1
P.35	do I2	As P.34	oFF	Status signal assignment Universal input 2
P.36	do I3	As P.34	oFF	Status signal assignment Universal input 3
P.37	do I4	As P.34	oFF	Status signal assignment Universal input 4
P.38	bUSNr	0 to 126	126	PROFIBUS address

6.4.2 Setting parameters

Procedure

The procedure for setting a parameter is as follows:

1. Press the <PAR> key for 5 seconds to change to the parameter menu.

   "MEnu" is shown on the left side in the middle section of the digital display and "PARAM" on the right. "MEnu" flashes. After five seconds, the digital display appears as shown below.

2. Set the measuring sensitivity. Using the ◀ and ▶ keys, select the parameter which fits the measuring channel from the parameter numbers P 1 to P 4. For example, if you want to parameterize measuring channel 1, select "P. 1". The selected measuring channel is displayed on the right side in the lower section of the digital display.

3. Using the ▼ and ▲ keys, set the value of the parameter for the desired measuring sensitivity. The measuring sensitivity setting takes effect immediately. The digital display appears as follows:

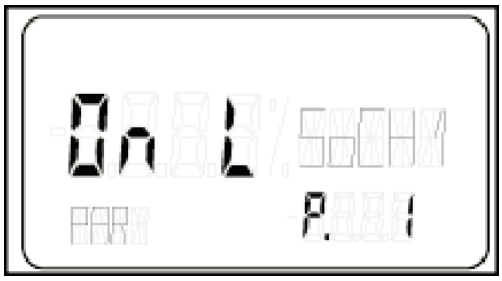


Figure 6-6 Digital display parameter menu

4. Repeat points 2 and 3 to

   - set the alarm threshold of the pre-alarm and main alarm.
   - set the response time of the alarm (P.13).
   - set the type of alarm acknowledgement (P.14).
   - to assign the status signal for the pre-alarm.
   - to assign the status signal for the main alarm.

5. Press the <MEAS> key to close the parameter menu.

Note

Adjustment of the parameter value takes effect immediately.

Press the <MEAS> key to return to the measured value display. At this point, the adjusted parameters are saved to ensured failsafe operation.

If a parameter lock is effective, "noPA" appears in the digital display when you attempt to make the adjustment and it is not possible to adjust the parameter.

See also

Parameter lock (Page 37)

6.4.3 Parameter lock

You can activate a parameter lock by special use of a universal input.

To do this, an electrical connection must be set up (e.g. jumper in device, external key switch) and the input configured accordingly.

input	Configuration	Connecting terminals
In 1	P.26/INP1 = noPA	57 = 58
In 2	P.27/INP2 = noPA	67 = 68
In 3	P.28/INP3 = noPA	77 = 78
In 4	P.29/INP4 = noPA	87 = 88

If several inputs are configured with the "noPA" function, the function is already activated by one circuit (OR).

6.5 Trace menu

6.5.1 Trace menu table

Timer value	Time unit	Timer name	Meaning
0 to 9999	SEc	P1-UP	"*UP" is the time before receipt of the final alarm, in which the associated alarm limit has been exceeded.
0 to 60 Hours.Minutes Days.Hours	Min h_M d_h	P1-T	"*-T" is the accumulated time since the associated alarm was received.
0 to 9999	SEc	A1-UP	See comment for timer name "P1-UP"
0 to 60 Hours.Minutes Days.Hours	Min h_M d_h	A1-T	See comment for timer name "P1-T"
0 to 9999	SEc	P2-UP	See comment for timer name "P1-UP"
0 to 60 Hours.Minutes Days.Hours	Min h_M d_h	P2-T	See comment for timer name "P1-T"
0 to 9999	SEc	A2-UP	See comment for timer name "P1-UP"
0 to 60 Hours.Minutes Days.Hours	Min h_M d_h	A2-T	See comment for timer name "P1-T"
0 to 9999	SEc	P3-UP	See comment for timer name "P1-UP"
0 to 60 Hours.Minutes Days.Hours	Min h_M d_h	P3-T	See comment for timer name "P1-T"
0 to 9999	SEc	A3-UP	See comment for timer name "P1-UP"

Timer value	Time unit	Timer name	Meaning
0 to 60 Hours.Minutes Days.Hours	Min h_M d_h	A3-T	See comment for timer name "P1-T"
0 to 9999	SEc	P4-UP	See comment for timer name "P1-UP"
0 to 60 Hours.Minutes Days.Hours	Min h_M d_h	P4-T	See comment for timer name "P1-T"
0 to 9999	SEc	A4-UP	See comment for timer name "P1-UP"
0 to 60 Hours.Minutes Days.Hours	Min h_M d_h	A4-T	See comment for timer name "P1-T"
0 to 60 Hours.Minutes Days.Hours Years.Days	Min h_M d_h y_d	oP-T	Resettable. The resettable timer "oP-T" (operation time) can be used to display the operating time of the pump after re-installation or repair.
- - - -	ALL	RESET	
0 to 60 Hours.Minutes Days.Hours Years.Days	Min h_M d_h y_d	LIV-T	Not resettable. The LIV-T Timer (live time) is not resettable, and shows the running time of the device.

Explanation of timer names using example of "P1-UP" and "P1-T"

P	Pre-alarm (PrAL)
1	Acoustic channel 1
UP	is the time before the sounding of the final alarm, in which the associated alarm limit is exceeded.
T	is the accumulated time since the associated alarm was received.

Explanation of timer names using example of "A3-UP" and "A3-T"

A	Main alarm (AL)
3	Acoustic channel 3
UP	is the time before the sounding of the final alarm, in which the associated alarm limit is exceeded.
T	is the accumulated time since the associated alarm was received.

6.5.2 Displaying and resetting the timer

Introduction

The trace menu is used to display and reset timers.

Procedure

1. Press the <TRA> key for 5 seconds.

   "MEnu" and "TRACE" are shown in the middle section of the digital display. "MEnu" flashes. After these 5 seconds, the appearance of the digital display is as shown below.
2. Select the timer name using the ◀ or ▶ keys.

Note

Timers for acoustic channels that are configured with "oFF" (possible for parameters P.1 to P.4) are not displayed.

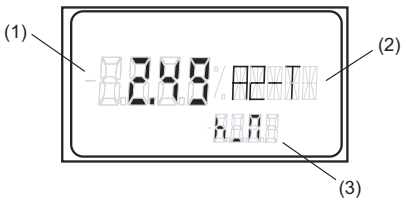


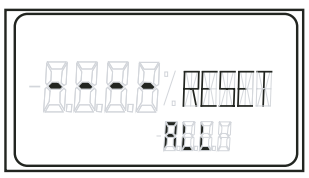
Figure 6-7 Trace menu digital display

(1) Timer value
(2) Timer name
(3) Time unit

Reset timers

The <ACK> key is used to reset the selected value. "rES" flashes in the digital display for 5 seconds. The value is then set to 0. If a parameter lock is activated, "noRE" is displayed and the value is not reset.

It is possible to reset all timers using the following setting in the trace menu:



All the counters except the running time counter of the device are reset ("LIV-T" timer).

See also

Trace function (Page 51)

Evaluating and processing signals

7

7.1 Evaluation of acoustic channels

Essentially, the four sensor inputs are evaluated according to the same principle, with the only differences being in the signal names and/or the associated parameters. If a channel is disconnected due to its configuration (P.1, P.2, P.3 or P.4 set to "oFF"), the measured value is set to "0" and no alarm is generated.

The electrical signals from the sensors are amplified, filtered and converted into a digital signal by an analog-digital converter.

This signal is used to determine the sound level. At the same time, the sensors are monitored for faults.

In case of a sensor fault, a substitute value of 0 ("on L") or 10000 ("on H") is set, depending on the configuration. If 10000 is selected, this also generates the alarm for the channel with the fault in addition to the buzzer fault signal. The measured value is then monitored by a limit sensor with hysteresis against a pre-alarm "PrAL*" and a main alarm "AL*".

The result signals "PrAL*" and "AL*" are used for evaluation by various trace timers. The final alarms "PrAL*" and "AL*" are generated only when the signals "PrAL*" and "AL*" are present for the configurable time "P.13/Time". The same delay time also applies it the value is below the alarm values. When the main alarm responds, the pre-alarm is also activated.

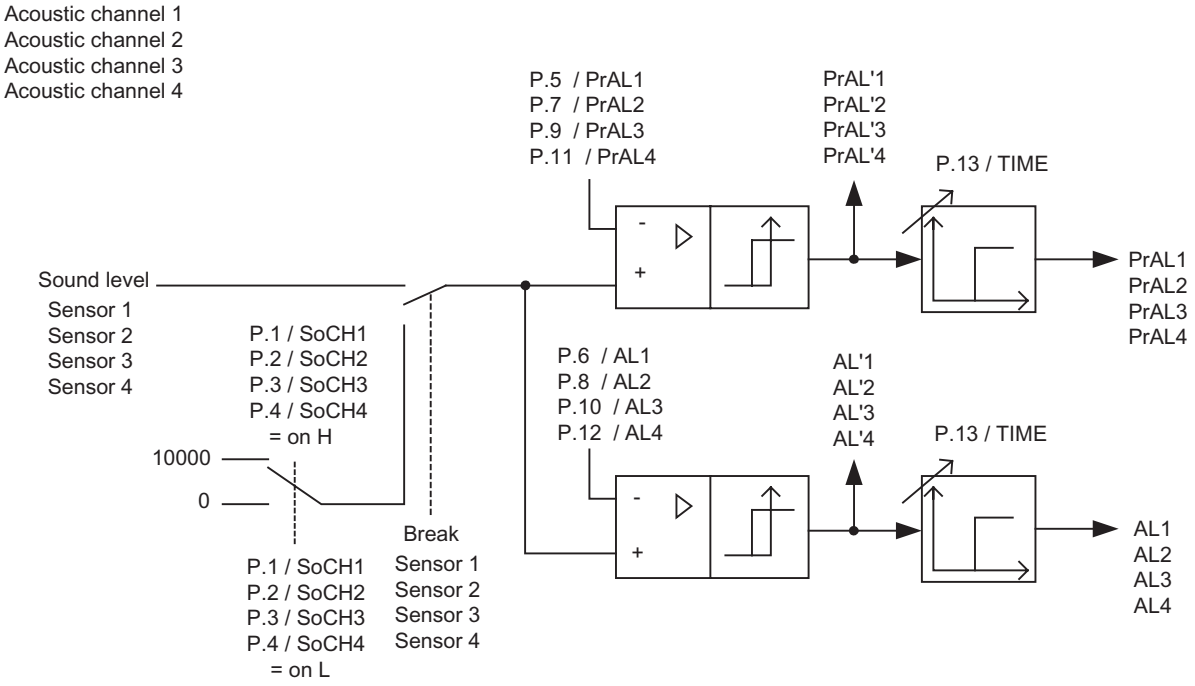


Figure 7-1 Acoustic channel function diagram

7.2 Evaluation of universal inputs

7.2.1 Universal input evaluation overview

Essentially, the four universal inputs are evaluated according to the same principle, with the only differences being in the signal names and/or the associated parameters.

The wiring and configuration (P.26 to P.29) should be adapted for the relevant signal type.

7.2.2 Evaluation of analog current signals

Relates to parameters

Parameter no.	Parameter name	Adjustment/display range	Comment
P.26 to P.29	"INP1" to "INP4"	0-20 4-20 20-0 20-4	Analog signal 0 to 20 mA->0 to 100% Analog signal 4 to 20 mA->0 to 100% Analog signal 20 to 0 mA->0 to 100% Analog signal 20 to 4 mA->0 to 100%
P.30 to P.33	"ALI1" to "ALI4"	-5.0% to 105.0%	Alarm for universal inputs 1 to 4

Procedure

The analog current signal is changed by internal measurement resistance into a voltage that is strengthened, filtered, and changed via an analog-digital exchanger into a digital signal. This measured value passes through a low pass filter with a fixed time constant. The measured value is then monitored for under and overflow, which is used to derive a fault message if appropriate. The following standardization is performed depending on the setting for the selected parameter:

P.*	0 %	100%
0 to 20	0 mA	20 mA
4 to 20	4 mA	20 mA
20 to 0	20 mA	0 mA
20 to 4	20 mA	4 mA

The percentage value obtained can then be displayed. It is then monitored to see if it exceeds the associated alarm "P.30/ALI*" to "P.33/ALI*". The digital signal "dol*" is then obtained. If the state is "0", the ▲ symbol (alarm not received) is displayed, if the state is "1", the ▼ symbol (alarm received).

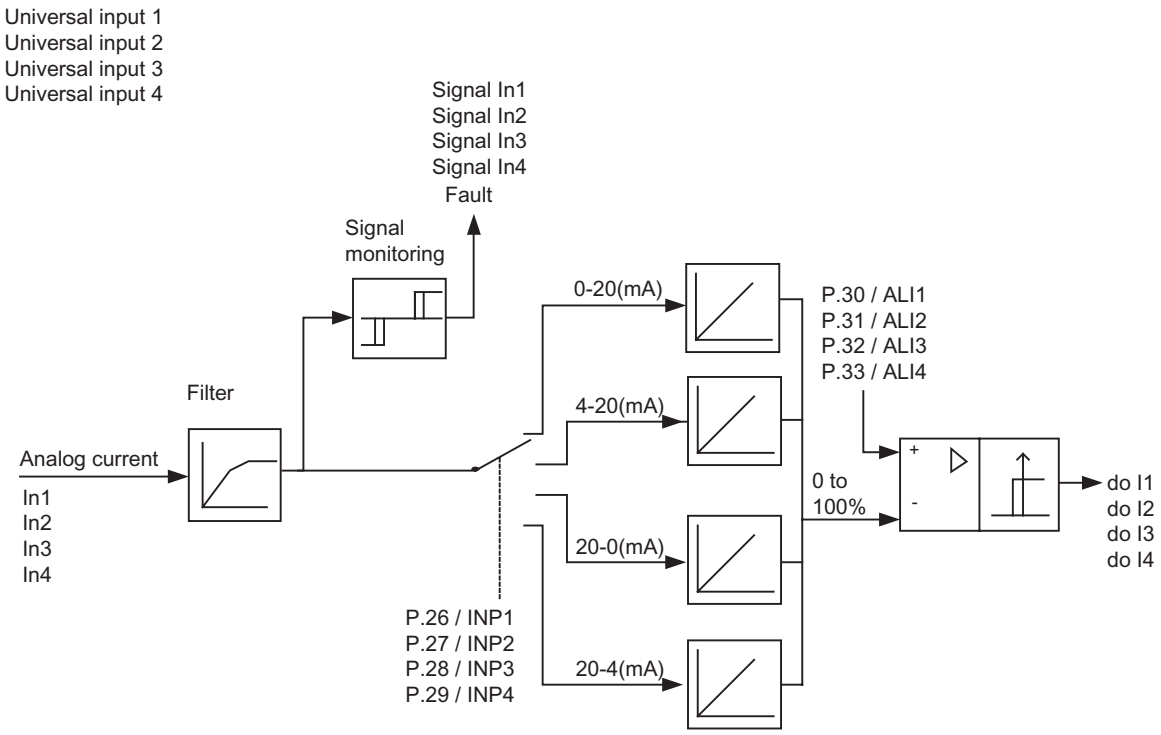


Figure 7-2 Universal input function diagram

7.2.3 Evaluation of 24 V digital signals

Relates to following parameters

Parameter no.	Parameter name	Adjustment/display range	Comment
P.26 to P.29	"INP1" to "INP4"	"24V" and "¬24V"	24 V-Digital signal >7 V -> High ¬24 V-Digital signal <4,5 V -> High

Evaluation

The electrical (voltage) signal is converted into a current by a multiplier and measured (see *Evaluation of analog current signals*). A comparator then uses this value to determine the Low or High level for the signal. The threshold value is set up so that a closing contact also generates a High signal via the 8.2 V source. With the parameter setting ¬24V, the digital signal is inverted.

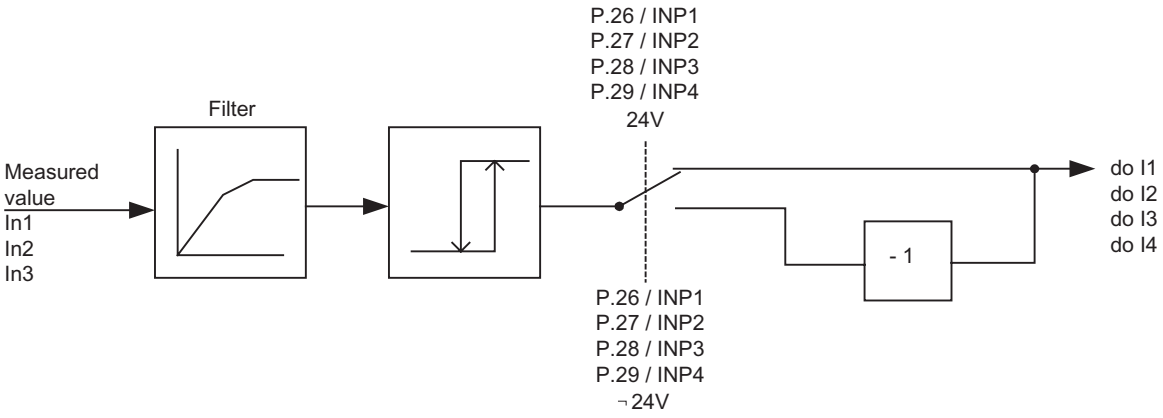


Figure 7-3 24 V digital signal function diagram

See also

Evaluation of analog current signals (Page 43)

7.2.4 Evaluation of digital signals in line with NAMUR

Relates to following parameters

Parameter no.	Parameter name	Adjustment/display range	Comment
P.26 to P.29	"INP1" to "INP4"	nAM ¬nAM	NAMUR digital signal >2.1 mA -> High ¬NAMUR digital signal <1.1 mA -> High

Evaluation

With an 8.2 V supply, NAMUR signal sensors deliver an output current of <1.1 mA (state "0") or >2.1 mA (state "1) for the two digital state. This current is measured as described under "Evaluation of analog current signals". The measured value is monitored to check that it stays within the limits. If necessary, a fault signal is generated. The measured value is then checked for its two signal states and the corresponding digital signal is generated. If the configuration "¬nAM" is selected, the digital signal is inverted.

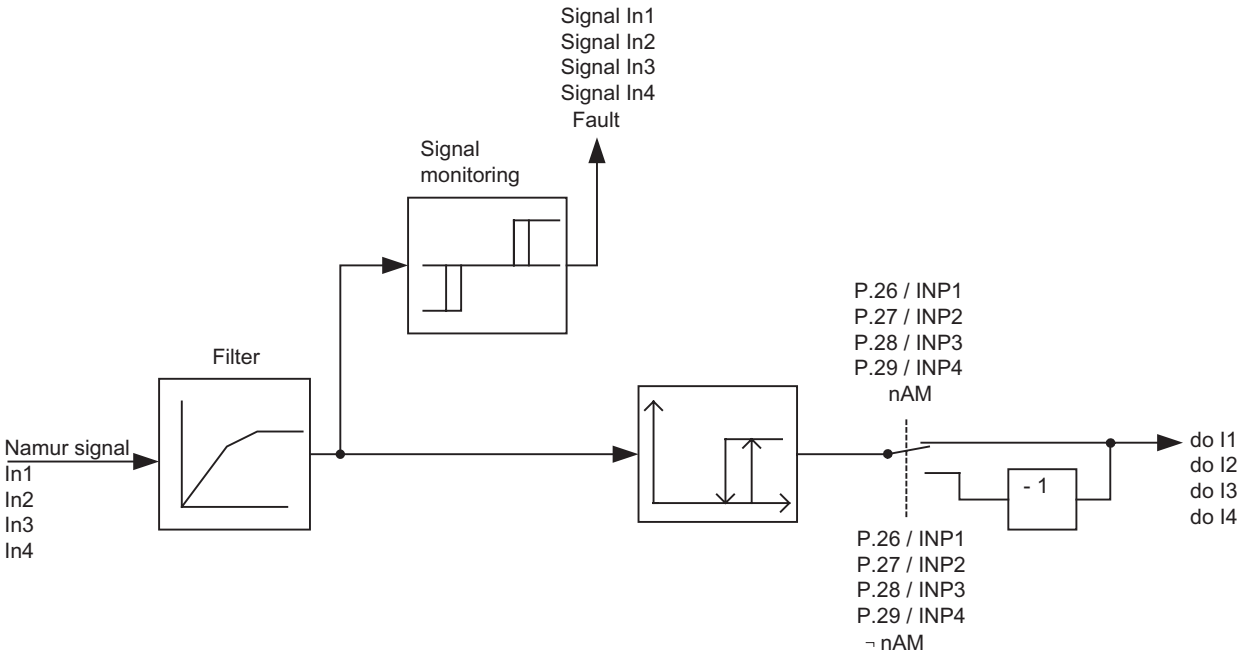


Figure 7-4 NAMUR digital signal function diagram

See also

Evaluation of analog current signals (Page 43)

7.2.5 Processing of input faults

Input fault signal

The fault signal "doFAI" is created from the OR of the following input fault signals:

- Faults in the acoustic emission sensors
- Universal input signal fault, e.g. >21 mA for analog current

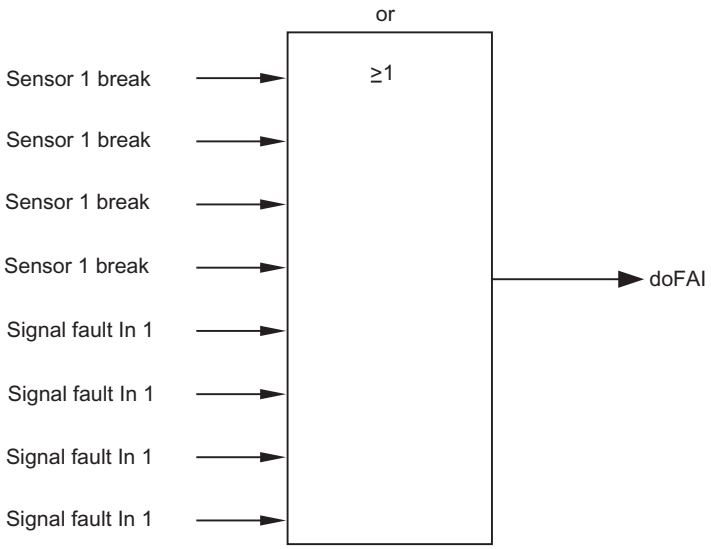


Figure 7-5 Input faults

7.2.6 Actuation of digital outputs

Actuation of digital outputs

The following internal digital signals are output at the 6 digital outputs "DO 1" to "DO 6":

- Pre-alarms "PrAL1" to "PrAL4"
- Main alarms "AL1" to "AL4"
- Limit exceeded/digital signal "doI1" to "doI4" from universal inputs
- Group fault signal for "doFAI" inputs
- Internal fault report (storage device/microcontroller) "doFAU"

The signal flow corresponds to positive logic. This means that a positive signal at the digital output results in low-impedance closing.

You can use the parameters P.15 to P.24 and P.34 to P.37 to select the digital output to be used to output the associated signal. You can also select whether the signal is to be output inverted.

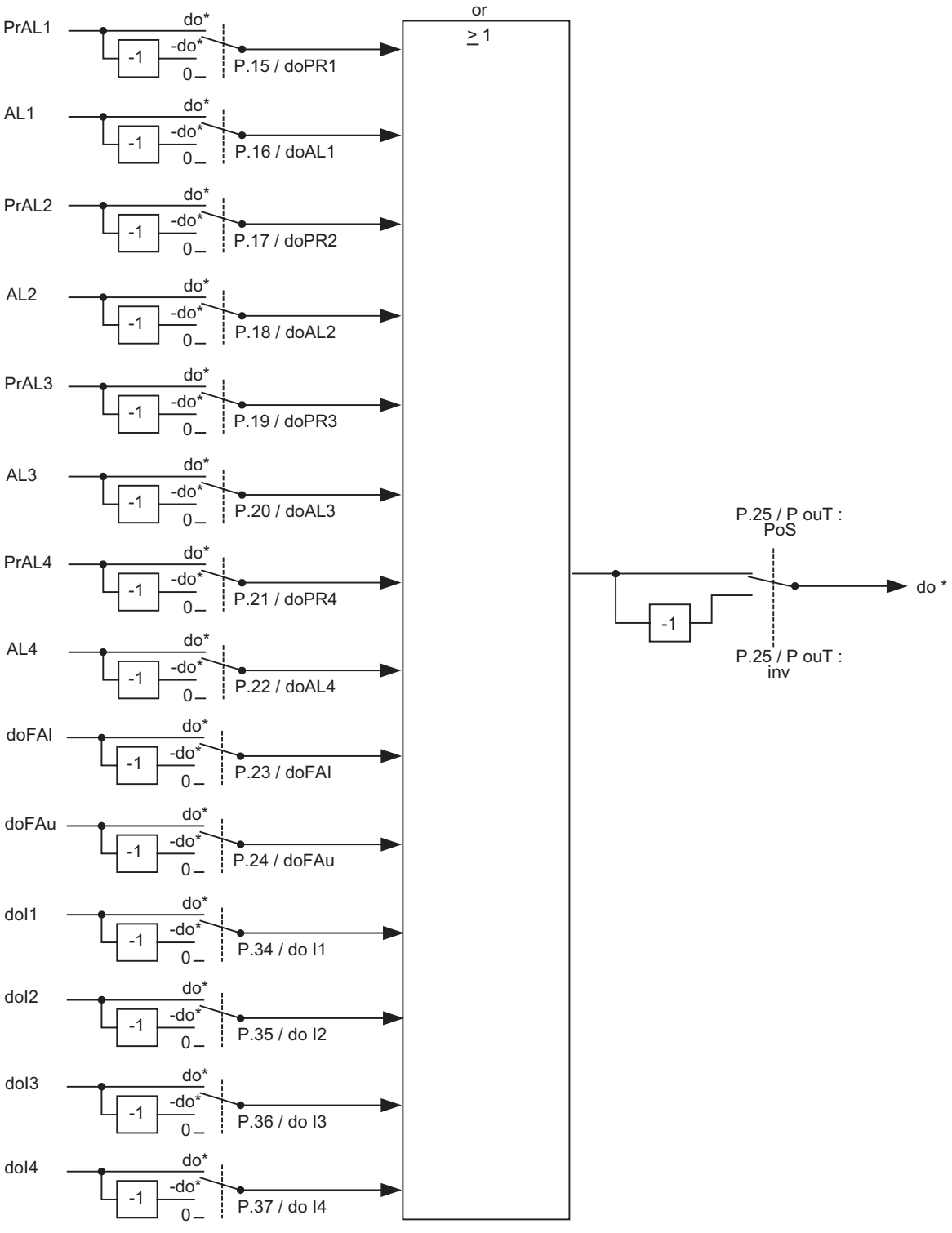


Figure 7-6 Digital output function diagram

* for digital outputs 1 to 6

Example

P.20/doAL3 = do4	The main alarm on acoustic channel 3 is output on digital output 4.
P.22/doAL4 = ¬do6	The main alarm on acoustic channel 4 is output inverted on digital output 6.

Note

The parameter "P.25/P ouT" reverses the direction of action for all outputs.

7.3 Trace function

Timer control

The effect of the parameter "P.13/TIME" and the function of the trace timers "A1-UP" and "A1-T" are described below using the example of acoustic channel 1 and the main alarm "P.6/AL1". The same function applies to all other channels, alarms (AL) and pre-alarms (PrAL).

The "*-UP" timers can be used to identify a temporary violation, before the final alarm is triggered. The "*-T" timers indicate how long the alarm has been responding for. This can be used to derive a schedule for repairs.

Time 1	The measured value exceeds the alarm value and timer "A1-UP" begins counting.
Time 2	The measured value falls below the alarm value hysteresis without the time criterion "P.13/TIME" being reached. The timer "A1-UP" stops and retains its value.
Time 3	As for time 1
Time 4	As for time 2
Time 5	As for time 1
Time 6	The time criterion "P13/TIME" is met. The alarm "AL1" is output. Timer "A1-UP" retains its value. Timer "A1-T" starts to count the time.
Time 7	The measured value falls below the alarm value hysteresis and activates the time criterion "P.13/TIME" again.
Time 8	The time "P13/TIME" has expired. The alarm is reset. Timer "A1-T" stops.

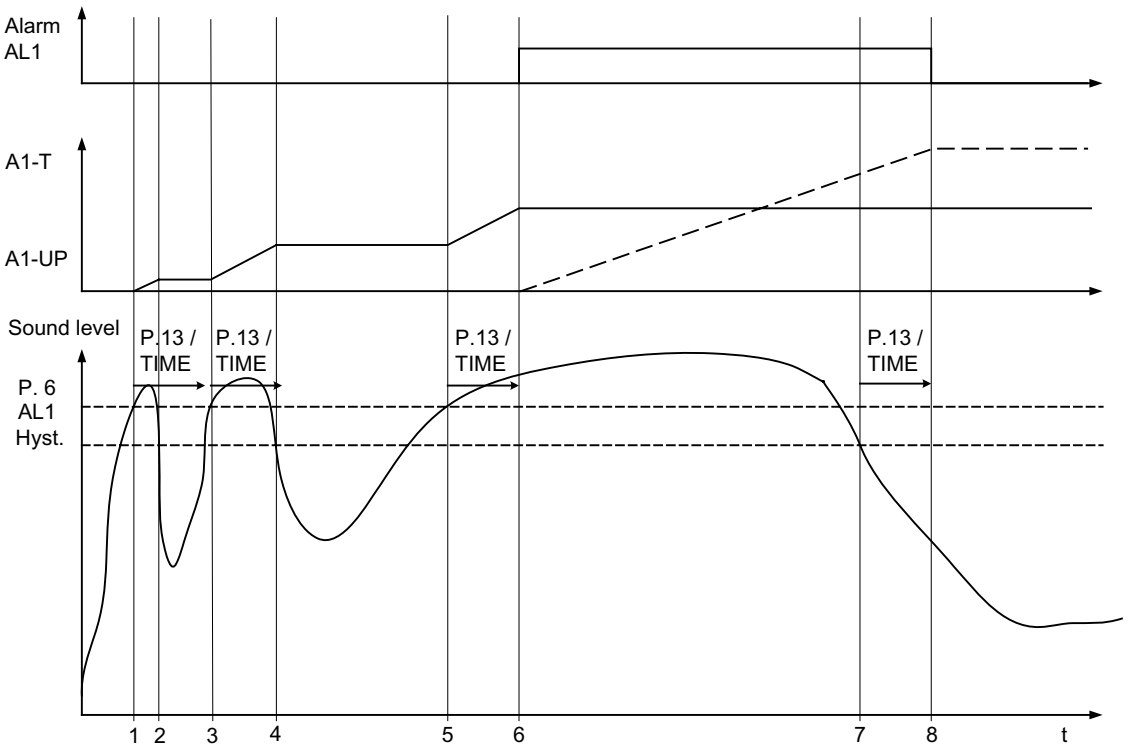


Figure 7-7 Trace evaluation

See also

Parameter lock (Page 37)

7.4 Acknowledgement

The effect of the parameter "P.14/AcK" is described below. For simplification, no hysteresis is plotted in the time diagram. The parameter value "P.13/TIME" for the response time is 0. The parameter "P.14/AcK" can be set to three values:

oFF	Acknowledgment here with the <ACK> key is not possible. The alarm occurs exclusively at exceeding or not reaching the alarm value.
St.Ac	Stored and can be acknowledged Time 1: Alarm value exceeded, alarm is output. Time 2: Acknowledgement with <ACK> key, alarm is reset. Time 3: Alarm is only set if the alarm value is exceeded again. Time 4: Value below alarm value, alarm remains saved. Time 5: Acknowledgement with <ACK> key, alarm is reset.
¬St.Ac	Not stored but can be acknowledged Time 1: Alarm value exceeded, alarm is output. Time 2: Acknowledgement with <ACK> key, alarm is reset. Time 3: Alarm is only set if the alarm value is exceeded again. Time 4: Value below alarm value and alarm canceled.

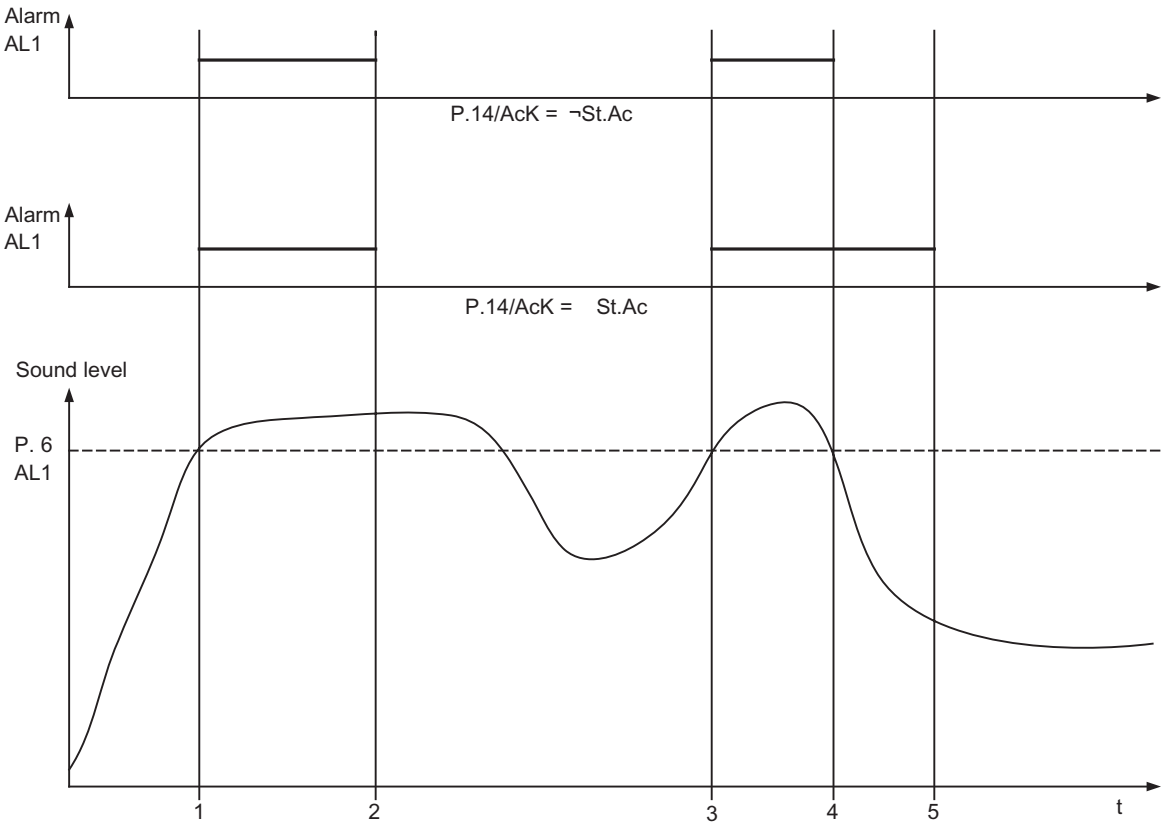


Figure 7-8 Acknowledgement evaluation

Commissioning

8

8.1 Overview

Introduction

The description below makes no claim to cover all the questions that could arise in relation to the pump.

The device does not need any tools or special equipment for commissioning.

The procedure for configuration is described in more detail in the "Operation" section. The setting can only be optimized while the pump is in operation. This is described below. For details of controlling and operating the pump, refer to the documentation supplied by the pump manufacturer. They are not covered in this manual.

Note

The limits for the acoustic channels are set at the factory at the maximum value of 999 (no alarm). All universal inputs are set to "oFF" (no signal assignment).

Condition

The information and values specified should only be used as a guide. It is necessary to define settings that are appropriate for your requirements and purpose.

NOTICE
Signal sensitivity Your personal specifications and settings determine the signal sensitivity of the diagnostics unit. Limits that are too narrowly defined may lead to frequent fault signals. Limits that are too generously defined may result in the alarm being late or not being triggered at all.

NOTICE
Ensure that all electrical connections and the installation of the sensors have been carried out properly and the cover is closed.

Note

The first settings undertaken after commissioning should be regularly checked and corrected if necessary. This is the case, if:

- Experience values or measured values indicate defects, which could possibly indicate defective valves and are not reported.
- After a repair it is identified that the report of a defect has occurred too early.

8.2 Commissioning after repairs

If repairs have been carried out on damaged pump valves, the timers may need to be reset in the trace menu. To do this, execute the "Reset All" menu item.

Specifications

9

9.1 Device

Input	
Acoustic channels	4
• Cycle time	10 ms
• Hysteresis alarm monitoring	12.5 % of alarm parameter
Universal input	
• Cycle time	80 ms
• Low pass filter time	1 s
Universal input analog current	
• Load	< 105 Ω
• Resolution	0.1 %
• Accuracy	0.5 %
• Fault signal	> 21 mA or < 3.6 mA (at 4 to 20 mA)
• Hysteresis alarm monitoring	0.5 %
• Static damage limit	40 mA, 4 V
Universal input 24 V digital signal	
• Input resistance	> 19 kΩ
• Low signal level	< 4.5 V or open
• High signal level	> 7 V
• Hysteresis	> 1 V
• Static damage limit	± 40 V
8.2 V source for NAMUR signal (DIN EN 60947-5-6)	
• Open-circuit voltage	8.2 V ± 0.3 V, short-circuit proof
• Internal resistance	< 950 Ω
• Static damage limit when there is a switching fault	+20 V/-10 V
Universal input NAMUR signal	
• Low signal level	< 1.4 mA
• High signal level	> 1.8 mA
• Hysteresis	> 0.2 mA
• Fault signal	< 0.1 mA/> 6 mA

Output	
Digital outputs	6
• Semiconductor relay	individually electrically insulated, short-circuit proof
• Switching voltage	AC 24 V/DC 36 V, any polarity
• Damage limit	AC 35 V/DC 50 V
• Internal resistance connected (low-resistance)	< 25 Ω
• Internal resistance open (high-resistance)	> 1 MΩ
• Max. switching current	100 mA

Rated conditions	
Installation conditions	Vertical wall mounting, cabling from below
Climate class	Class 4K4 as per EN 60721-3-4
Max. perm. ambient temperature	-20°C ... +60°C (-4°F ... 140°F)
Mechanical load	Class 4M3 as per EN 60721-3-4
Degree of protection class as per EN 60 529	IP65
Electromagnetic compatibility	
• Interference emission and interference resistance	As per EN 61326 and NAMUR NE 21
Operating limits with water	
Discharge side	≥ 10 bar a
Stroke rate	4 ... 200^{-1}

Construction	
Weight (without options)	Approx. 2.5 kg
Dimensions (L x W x H) in mm (inch)	172 x 320 x 80 (6.8 x 12.6 x 3.2)
Housing material	Macrolon (polycarbonate + 20 % fiber glass)
Electrical connection via screw terminals	• Fixed 2.5 mm (0.984") • Flexible 1.5 mm (0.590") • Flexible with ferrules 1.5 mm (0.590")
Cable entry via plastic screw couplings	• 1 x Pg 13.5 for 1 cable, ∅ 6 ... 12 mm (0.236 ... 0.472") (e.g. PROFIBUS) • 1 x Pg 13.5 for 3 cables, ∅ 4 mm (0.157") • 1 x Pg 11 for 1 cable, ∅ 4 ... 10 mm (0.157 ... 0.394") • 4 x Pg 11 for each 2 cables, ∅ 4 mm (0.157") (e.g. sensors)

Auxiliary power	
Rated voltage	DC 24 V
Working range	DC 19 V to max. 36 V
Current consumption	< 100 mA

Communication	
PROFIBUS DP	RS485, connectable terminating resistor
Protocol	Cyclically with master C1 and acyclically with master C2
PC parameter software	SIMATIC PDM (not the scope of delivery)

9.2 Sensor

Rated conditions	
Permissible operating temperature	-40 °C ... 110 °C (-40 °F … 230 °F)
Degree of protections as per EN 60529	IP66/IP68
Mechanical load	Class 4M7 as per DIN EN 60721-3-4
Climate class	Class 4K4 as per DIN EN 60721-3-4

Construction	
• Piezoceramic sensor with preamplifier • Encapsulated electronics • 4-wire cable with anti-kink connector	
Housing material	Stainless steel 1.4571 (316Ti SST)
Cable	Ends with ferrules and cable lug for connection to the SITRANS DA400
Weight	125 g (0.276 lb)
Dimensions (L x W x H) in mm (inch)	26 x 29 x 40 (1.02 x 1.14 x 1.57)

Certificates and approvals	
Explosion protection	
Intrinsic safety "i"	TÜV 05 ATEX 2876 X
Marking	II 1 G EEx ia IIC T6/T5/T4 or II 1 D EEx ia D 20, 21, 22 T160
Permissible ambient temperature	
• Category 1G	
- Temperature class T4, T5	-20 … +60 C (-4 … +140 F)
- Temperature class T6	-20 … +50 C (-4 … +122 F)
• Category 2G	
- Temperature class T4	-40 … +110 C (-40 … +230 F)
- Temperature class T5	-40 … +80 C (-40 … +176 F)
- Temperature class T6	-40 … +65 C (-40 … +149 F)
• Category 1D or 2D	
- Temperature class T160	-40 … +110 C (-40 … +230 F)

Dimension drawings

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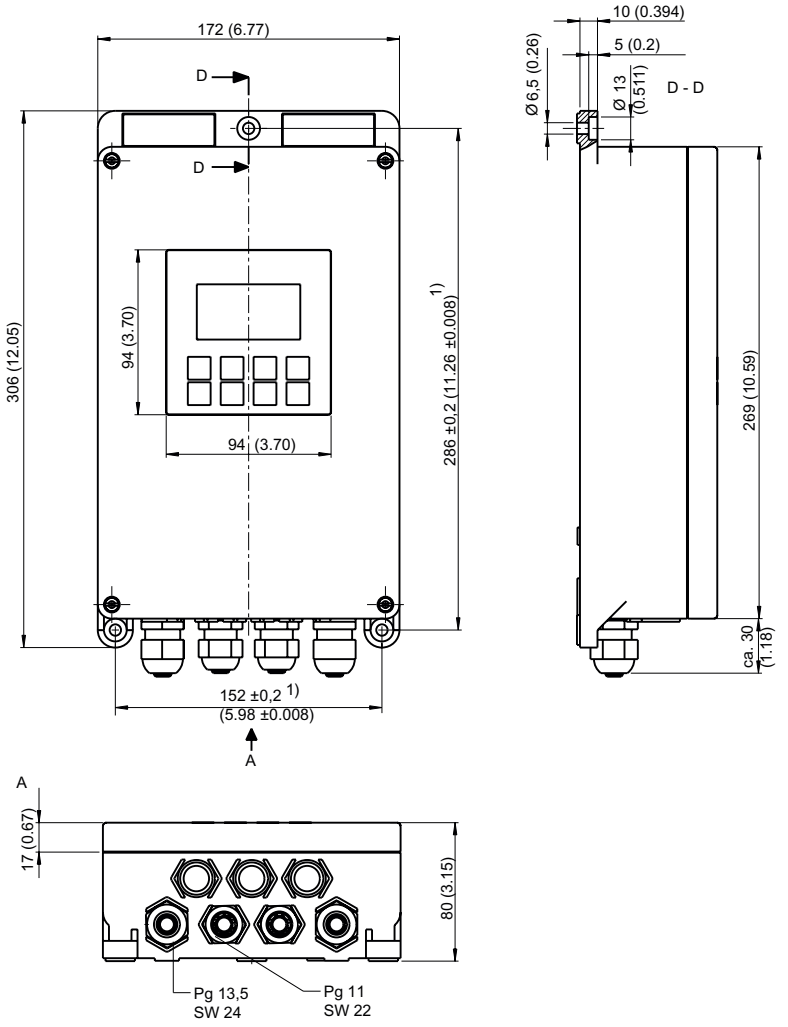
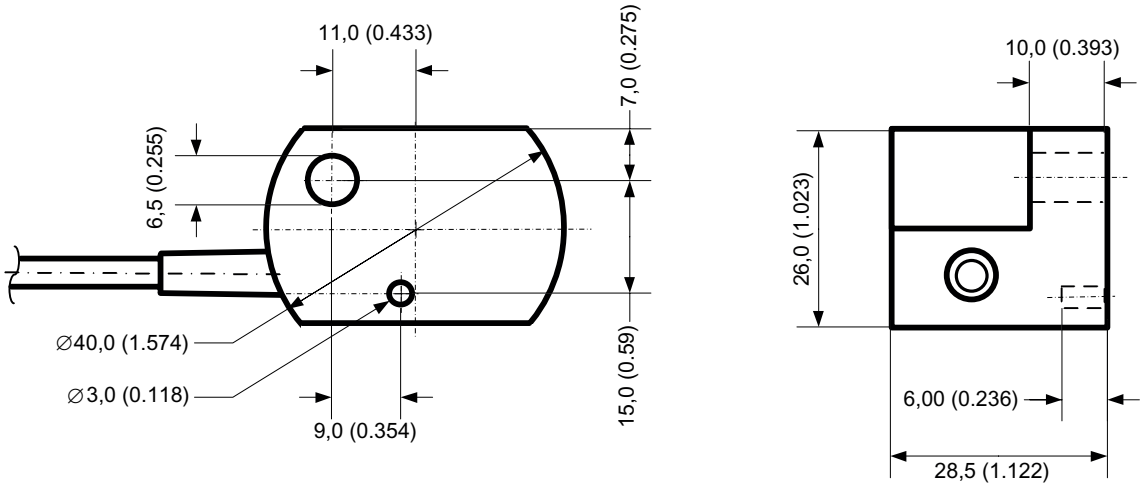
10.1 Dimension drawing of the device



1) 3 mounting holes (M6)

Dimensions in mm (inch)

10.2 Dimension drawing of the sensor



Dimensions in mm (inches)

10.3 Dimensional drawing of the ex-barrier

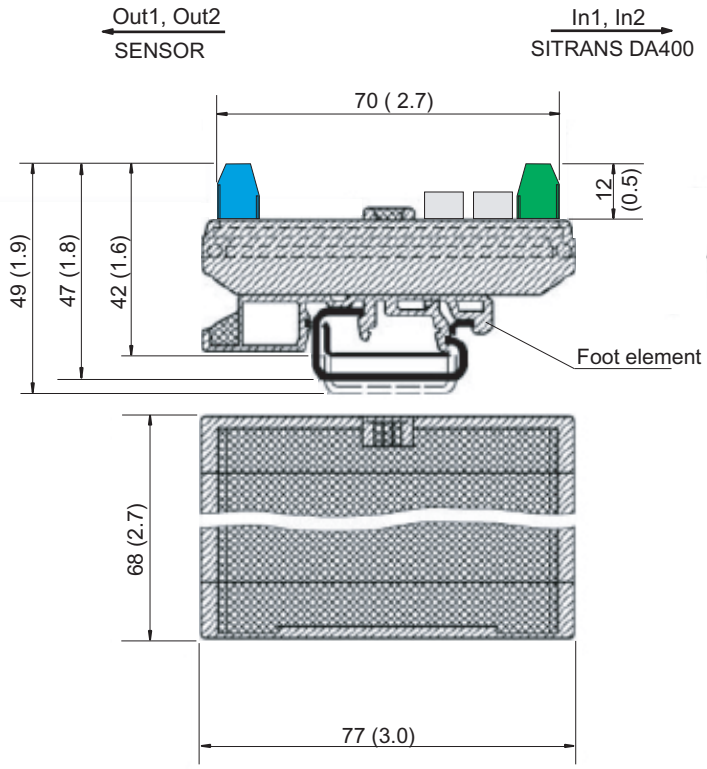


Figure 10-1 Dimensional drawing of the ex-barrier, dimensions in mm (inch)

PROFIBUS DP

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11.1 Overview

PROFIBUS connection

The PROFIBUS connection allows connection to both a class 1 master (e.g. SIMATIC S7) for cyclic communication of measured values and status and to a class 2 master (e.g. SIMATIC PDM) for acyclic transmission of parameters.

The device master file "SIEM8115.gsd" is available for integration and configuration of the SITRANS DA in a PROFIBUS network. It describes all the required information for cyclic communication (particularly supported baud rates, number of input/output bytes including consistency) with a class 1 PROFIBUS master (e.g. SIMATIC S7).

Integrating the device master file (GSD) into a planning tool (e.g. SIMATIC STEP 7, HW-Config) facilitates simple and fault-free commissioning. The selected module structure allows the user to adapt the type and quantity of communication data to the specific application. This allows the bus and CPU loads to be influenced accordingly.

One of the modules described below must be selected during planning.

1. Module "Status: 4 Sound"

Table 11-1 Config Byte: 0x13 -> 4 byte input

Byte no.	Signal name
0	Sensor 1 status
1	Sensor 2 status
2	Sensor 3 status
3	Sensor 4 status

2. Module "Status: 4 Sound / 4 AI"

Table 11-2 Config Byte: 0x17 -> 8 byte input

Byte no.	Signal name
0	Sensor 1 status
1	Sensor 2 status
2	Sensor 3 status
3	Sensor 4 status
4	Universal input 1 status
5	Universal input 2 status
6	Universal input 3 status
7	Universal input 4 status

3. Module "Status: 4 Sound / 4 AI / Binary"

Table 11-3 Config Byte: 0x17,0x17 -> 16 byte input

Byte no.	Signal name
0	Sensor 1 status
1	Sensor 2 status
2	Sensor 3 status
3	Sensor 4 status
4	Universal input 1 status
5	Universal input 2 status
6	Universal input 4 status
7	Universal input 5 status
8 to 15	8 byte binary status signals

4. Module “4 SoundAmpl+Status”

Table 11-4 Config Bytes: 0x94,0x94,0x94,0x94 -> 20 byte input

Byte no.	Signal name
0 to 3	Sensor 1 measured value
4	Sensor 1 status
5 to 8	Sensor 2 measured value
9	Sensor 2 status
10 to 13	Sensor 3 measured value
14	Sensor 3 status
15 to 18	Sensor 4 measured value
19	Sensor 4 status

5. Module "4 SoundAmpl+St/Binary Status"

Table 11-5 Config Bytes: 0x94,0x94,0x94,0x94,0x17 -> 28 byte input

Byte no.	Signal name
0 to 3	Sensor 1 measured value
4	Sensor 1 status
5 to 8	Sensor 2 measured value
9	Sensor 2 status
10 to 13	Sensor 3 measured value
14	Sensor 3 status
15 to 18	Sensor 4 measured value
19	Sensor 4 status
20 to 27	8 byte binary status signals, bit coded

6. Module "Param/4 SoundAmpl+St/4 AI + St"

Table 11-6 Config Bytes: 0xF2,0x94,0x94,0x94,0x94,0x94,0x94,0x94,0x94 -> 46 byte input / 6 byte output

Byte no.	Signal name
0 to 5	6 byte input/output for indexed reading/writing of parameters
6 to 9	Sensor 1 measured value
10	Sensor 1 status
11 to 14	Sensor 2 measured value
15	Sensor 2 status
16 to 19	Sensor 3 measured value
20	Sensor 3 status
21 to 24	Sensor 4 measured value
25	Sensor 4 status
26 to 29	Universal input 1 measured value
30	Universal input 1 status
31 to 34	Universal input 2 measured value
35	Universal input 2 status
36 to 39	Universal input 3 measured value
40	Universal input 3 status
41 to 44	Universal input 4 measured value
45	Universal input 4 status

7. Module "Param/4 SoundAmpl+St/4 AI + St/Bin"

Table 11-7 Config Bytes: 0xF2,0x94,0x94,0x94,0x94,0x94,0x94,0x94,0x94,0x17 -> 54 byte input / 6 byte output

Byte no.	Signal name
0 to 5	6 byte input/output for indexed reading/writing of parameters
6 to 9	Sensor 1 measured value
10	Sensor 1 status
11 to 14	Sensor 2 measured value
15	Sensor 2 status
16 to 19	Sensor 3 measured value
20	Sensor 3 status
21 to 24	Sensor 4 measured value
25	Sensor 4 status
26 to 29	Universal input 1 measured value
30	Universal input 1 status
31 to 34	Universal input 2 measured value
35	Universal input 2 status
36 to 39	Universal input 3 measured value
40	Universal input 3 status
41 to 44	Universal input 4 measured value
45	Universal input 4 status
46 to 53	8 byte binary status signals, bit coded

11.2 Measured value and status format

Measured value number format: 4 byte float (IEEE)

Table 11-8 Status signals

Value	Meaning	Comment
0x1C	Out of service	For configuration "oFF" (P.1 to P.4 and P.26 to P.29)
0x10	Sensor failure	Failure or exceeding of rated range
0x80	Good / no alarm	
0x88	Good / pre-alarm received	Acoustic channels only
0x8C	Good / main alarm received	
0x0C	Device defective	

11.3 Meaning of 8 byte binary status signals

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	Res.	Res.	DO6	DO5	DO4	DO3	DO2	DO1
Byte 2	S2 St.	Res.	PrAL2	AL2	S1 St.	Res.	PrAL1	A L1
Byte 3	S4 St.	Res.	PrAL4	AL4	S3 St.	Res.	PrAL3	AL3
Byte 4	doI4St.	doI4	doI3St.	doI3	doI2St.	doI2	doI1St.	doI1
Byte 5 [1)]	MUF4	MUF3	MUF2	MUF1	FAI		FAU	
Byte 6 [1)]	Uni4	Uni3	Uni2	Uni1	MUF4	MUF3	MUF2	MUF1
Byte 7								
Byte 8						noPA		Par

1) From PRB Firmware 2.02.00

Meaning of individual bytes

Table 11-9 Byte 1

Byte 1	Code	Meaning
Bit 7	Res.	Reserved
Bit 6	Res.	Reserved
Bit 5	DO6	=1 -> Digital output 6 has responded
Bit 4	DO5	=1 -> Digital output 5 has responded
Bit 3	DO4	=1 -> Digital output 4 has responded
Bit 2	DO3	=1 -> Digital output 3 has responded
Bit 1	DO2	=1 -> Digital output 2 has responded
Bit 0	DO1	=1 -> Digital output 1 has responded

Table 11-10 Byte 2

Byte 2	Code	Meaning
Bit 7	S2 St.	=1 -> Alarms for acoustic channel 2 are valid
Bit 6	Res.	Reserved
Bit 5	PrAL2	=1 -> Pre-alarm of acoustic channel 2 is received
Bit 4	AL2	=1 -> Main alarm of acoustic channel 2 is received
Bit 3	S1 St.	=1 -> Alarms for acoustic channel 1 are valid
Bit 2	Res.	Reserved
Bit 1	PrAL1	=1 -> Pre-alarm received from acoustic channel 1
Bit 0	AL1	=1 -> Main alarm received from acoustic channel 1

Table 11-11 Byte 3

Byte 3	Code	Meaning
Bit 7	S4 St.	=1 -> Alarms for acoustic channel 4 are valid
Bit 6	Res.	Reserved
Bit 5	PrAL4	=1 -> Pre-alarm received from acoustic channel 4
Bit 4	AL4	=1 -> Main alarm received from acoustic channel 4
Bit 3	S3 St.	=1 -> Alarms for acoustic channel 3 are valid
Bit 2	Res.	Reserved
Bit 1	PrAL3	=1 -> Pre-alarm received from acoustic channel 3
Bit 0	AL3	=1 -> Main alarm received from acoustic channel 3

Table 11-12 Byte 4

Byte 4	Code	Meaning
Bit 7	dol4St.	=1 -> Status "dol4" valid
Bit 6	dol4	Digital signal from universal input 4
Bit 5	do3St.	=1 -> Status "dol3" valid
Bit 4	dol3	Digital signal from universal input 3
Bit 3	dol2St.	=1 -> Status "dol2" valid
Bit 2	dol2	Digital signal from universal input 2
Bit 1	dol1St.	=1 -> Status "dol1" valid
Bit 0	dol1	Digital signal from universal input 1

Table 11-13 Byte 5

Byte 5	Code	Meaning
Bit 7	MUF4	=1 -> Sensor 4 fault
Bit 6	MUF3	=1 -> Sensor 3 fault
Bit 5	MUF2	=1 -> Sensor 2 fault
Bit 4	MUF1	=1 -> Sensor 1 fault
Bit 3	FAI	=1 -> Fault on at least 1 acoustic channel or universal input
Bit 2		
Bit 1	FAU	=1 -> Internal fault signal
Bit 0		

Table 11-14 Byte 6

Byte 6	Code	Meaning
Bit 7	Uni4	=1 -> Universal input 4 fault
Bit 6	Uni3	=1 -> Universal input 3 fault
Bit 5	Uni2	=1 -> Universal input 2 fault
Bit 4	Uni1	=1 -> Universal input 1 fault
Bit 3	MUF4	=1 -> Sensor 4 fault
Bit 2	MUF3	=1 -> Sensor 3 fault
Bit 1	MUF2	=1 -> Sensor 2 fault
Bit 0	MUF1	=1 -> Sensor 1 fault

Table 11-15 Byte 8

Byte 8	Code	Meaning
Bit 7		
Bit 6		
Bit 5		
Bit 4		
Bit 3		
Bit 2	NoPA	=1 -> Parameter lock "noPA" active for front configuration
Bit 1		
Bit 0	Par	=1 -> Device is in "Configuration" menu

11.4 Read/write parameters

Block "Input byte"/"Output byte"

This block, made up of six input bytes and six output bytes, is used to read or write device parameters and diagnostic counters by indexing.

"Master"

Byte no.	Output	
0	Job	0x01 : Read 0x02 : Write
1	Parameter number (index)	
2	Dat 1	Data byte for 1, 2 or 4 byte objects
3	Dat 2	Data byte for 1, 2 or 4 byte objects
4	Dat 3	Data byte for 1, 2 or 4 byte objects
5	Dat 4	Data byte for 1, 2 or 4 byte objects

"Slave" response to "Read" job

Byte no.	input	
0	Job	0x01 : Dat 1-4 valid 0x07 : Parameter number invalid 0x09 : Job invalid
1	Parameter number (index)	Reflected number from read job
2	Dat 1	Data byte for 1, 2 or 4 byte objects
3	Dat 2	Data byte for 1, 2 or 4 byte objects
4	Dat 3	Data byte for 1, 2 or 4 byte objects
5	Dat 4	Data byte for 1, 2 or 4 byte objects

"Slave" response to "Write" job

Byte no.	input	
0	Job	0x01 : Job is executed with values reflected below 0x07 : Parameter number invalid 0x08 : Data invalid 0x09 : Job invalid
1	Parameter number (index)	Reflected number from write job
2	Dat 1	Data byte, reflected from write job
3	Dat 2	Data byte, reflected from write job
4	Dat 3	Data byte, reflected from write job
5	Dat 4	Data byte, reflected from write job

11.5 Examples

Notation

The notation 0x00 is the code used for hexadecimal in the C programming language.

Example 1

Parameter "P.5" has the value "260" (0x104)
Read parameter "P.5"

Master

Byte no.	Output data	Comment
0	0x01	Read job
1	0x05	Index 5 for P.5
2	0x00	Byte not used
3	0x00	Byte not used
4	0x00	Byte not used
5	0x00	Byte not used

Slave response

Byte no.	Input data	Comment
0	0x01	Response read job present
1	0x05	Reflected index number
2	0x00	Data byte
3	0x00	Data byte
4	0x01	Data byte
5	0x04	Data byte

Example 2

Write parameter P.13 with value 400 (0x190)

Master

Byte no.	Output	Comment
0	0x02	Write job
1	0x0D	Index for P.13
2	0x00	Data byte
3	0x00	Data byte
4	0x01	Data byte
5	0x90	Data byte

Slave response

Byte no.	input	Comment
0	0x01	Job executed
1	0x0D	Reflected index number
2	0x00	Reflected data byte
3	0x00	Reflected data byte
4	0x01	Reflected data byte
5	0x90	Reflected data byte

11.6 Index of objects

Meaning

Index of parameters

Index no. in byte no. 1	Meaning	Data in byte no.				Format	Unit	Range of values
1		2	3	4	5			
0	P. 0			x	x			1.00 – 99.99
1	P. 1				x	unsigned integer		0…2
2	P. 2				x	unsigned integer		0…2
3	P. 3				x	unsigned integer		0…2
4	P. 4				x	unsigned integer		0…2
5	P. 5			x	x	unsigned integer		0....9999
6	P. 6			x	x	unsigned integer		0....9999
7	P. 7			x	x	unsigned integer		0....9999
8	P. 8			x	x	unsigned integer		0....9999
9	P. 9			x	x	unsigned integer		0....9999
10	P.10			x	x	unsigned integer		0....9999
11	P.11			x	x	unsigned integer		0....9999
12	P.12			x	x	unsigned integer		0....9999
13	P.13			x	x	unsigned integer	sec	0…1000
14	P.14				x	unsigned integer		0…2
15	P.15				x	unsigned integer		0..12
16	P.16				x	unsigned integer		0..12
17	P.17				x	unsigned integer		0..12
18	P.18				x	unsigned integer		0..12
19	P.19				x	unsigned integer		0..12
20	P.20				x	unsigned integer		0..12
21	P.21				x	unsigned integer		0..12
22	P.22				x	unsigned integer		0..12
23	P.23				x	unsigned integer		0..12
24	P.24				x	unsigned integer		0..12
25	P.25				x	unsigned integer		0..1
26	P.26				x	unsigned integer		0..9
27	P.27				x	unsigned integer		0..9
28	P.28				x	unsigned integer		0..9
29	P.29				x	unsigned integer		0..9
30	P.30	x	x	x	x	float	%	-5,0...105,0
31	P.31	x	x	x	x	float	%	-5,0...105,0
32	P.32	x	x	x	x	float	%	-5,0...105,0

Index no. in byte no. 1	Meaning	Data in byte no.				Format	Unit	Range of values
1		2	3	4	5			
33	P.33	x	x	x	x	float	%	-5,0...105,0
34	P.34				x	unsigned integer		
35	P.35				x	unsigned integer		
36	P.36				x	unsigned integer		
37	P.37				x	unsigned integer		
38	P.38				x	unsigned integer		0...126

Index of counters

Index no. in byte no. 1	Meaning	Data in byte no.				Format	Unit
1		2	3	4	5		
128	P1-UP			x	x	unsigned integer	sec
129	P1-T			x	x	unsigned integer	min
130	A1-UP			x	x	unsigned integer	sec
131	A1-T			x	x	unsigned integer	min
132	P2-UP			x	x	unsigned integer	sec
133	P2-T			x	x	unsigned integer	min
134	A2-UP			x	x	unsigned integer	sec
135	A2-T			x	x	unsigned integer	min
136	P3-UP			x	x	unsigned integer	sec
136	P3-T			x	x	unsigned integer	min
138	A3-UP			x	x	unsigned integer	sec
139	A3-T			x	x	unsigned integer	min
140	P4-UP			x	x	unsigned integer	sec
128	P1-UP			x	x	unsigned integer	sec
129	P1-T			x	x	unsigned integer	min
130	A1-UP			x	x	unsigned integer	sec
131	A1-T			x	x	unsigned integer	min
132	P2-UP			x	x	unsigned integer	sec
133	P2-T			x	x	unsigned integer	min
134	A2-UP			x	x	unsigned integer	sec
135	A2-T			x	x	unsigned integer	min
136	P3-UP			x	x	unsigned integer	sec
136	P3-T			x	x	unsigned integer	min
138	A3-UP			x	x	unsigned integer	sec
139	A3-T			x	x	unsigned integer	min
140	P4-UP			x	x	unsigned integer	sec
141	P4-T			x	x	unsigned integer	min
142	A4-UP			x	x	unsigned integer	sec
143	A4-T			x	x	unsigned integer	min
144	Alarm ack *				x	unsigned integer	
150	oP-T	x	x	x	x	long integer	h
151	LIV-T	x	x	x	x	long integer	h

* Acknowledgement of alarms (pre and main alarm) with associated bit=1 (P.14=ST.Ac/¬ST.Ac only).

Byte 8	Meaning
Bit 7	
Bit 6	PrAL4 / AL4
Bit 5	
Bit 4	PrAL3 / AL3
Bit 3	
Bit 2	PrAL2 / AL2
Bit 1	
Bit 0	PrAL1 / AL1

Index