Operating Manual
MHM-97442, Rev 2.07
November 2023

Machinery Health™ Monitor

AMS 6300 SIS, Overspeed Protection System

EMERSON

Disclaimer

This manual is provided for informational purposes. EMERSON MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Emerson shall not be liable for errors, omissions, or inconsistencies that may be contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. Information in this document is subject to change without notice and does not represent a commitment on the part of Emerson. The information in this manual is not all-inclusive and cannot cover all unique situations.

Patents

The product(s) described in this manual are covered under existing and pending patents.

Contents

1 General

1.1 Using this manual

This manual contains information concerning the use of the device.

Read the operating manual completely prior to starting installation and operating the device. Comply with all safety instructions.

Include the operating manual when transferring the device to third parties.

Note
When requesting technical support, please indicate type and serial number from the type plate.

Table 1-1 shows a list of documents that are referred to in this operating manual.

Table 1-1: Referenced documents

MHM-97853	Safety manual Eddy Current Measuring Chains
MHM-97851	Safety manual AMS 6300 SIS
MHM-97858	Installation Guide CON 011 eddy current signal converters
MHM-97859	Installation Guide CON 021/031 eddy current signal converters
MHM-97860	Installation Guide CON 041 eddy current signal converters
MHM-97866	Installation Guide PR 642x eddy current sensors

1.2 Symbols

Note
This symbol marks passages that contain important information.

⚠ CAUTION

This symbol marks operations that can lead to malfunctions or faulty measurements, but will not damage the device.

⚠ DANGER

A danger indicates actions that can lead to property damage or personal injury.

⚠	Safety related parameters in the user interface of the configuration software are marked with this symbol.

	According to IEC 61010, this symbol means that the documentation of the device must be completely read and understood before installation and commissioning of the device. Observe all safety related instructions in this document.

	According to IEC 61010, this symbol means that this device must be operated with DC voltage.

1.3 Liability and guarantee

Emerson is not liable for damages that occur due to improper use. Proper use also includes the knowledge of, and compliance with, this document.

Customer changes to the device that have not been expressly approved by Emerson will result in the loss of guarantee.

Due to continuous research and further development, Emerson reserves the right to change technical specifications without notice.

1.4 Incoming goods inspection

Check the content of the shipment to ensure that it is complete; visibly inspect the goods to determine if the device has been damaged during transport. The following parts are included in the scope of delivery and must be contained in the shipment.

- AMS 6300 SIS Overspeed Protection System (According to the ordered components)
- Operating manual on CD
- Safety Manual AMS 6300 SIS (only with SIL relevant systems)

If the contents are incomplete, or if you observe any defects, file a complaint with the carrier immediately. Inform the responsible Emerson sales organization so your device can be replaced. In this case, attach a tag with customer name and the observed defect.

1.5 Firmware update

The firmware for A6370 Speed monitors can be updated with a separate update tool on-site.

1.6 Technical support

You may need to ship this product for return, replacement, or repair to an Emerson Product Service Center. Before shipping this product, contact Emerson Product Support to obtain a Return Materials Authorization (RMA) number and receive additional instructions.

Product Support

Emerson provides a variety of ways to reach your Product Support team to get the answers you need when you need them:

Phone	Toll free 800.833.8314 (U.S. and Canada) +1.512.832.3774 (Latin America) +63.2702.1111 (Asia Pacific, Europe, and Middle East)
Email	Guardian.GSC@Emerson.com
Web	http://www.emerson.com/en-us/contact-us

To search for documentation, visit http://www.emerson.com.

To view toll free numbers for specific countries, visit http://www.emersonprocess.com/technicalsupport.

Note
If the equipment has been exposed to a hazardous substance, a Material Safety Data Sheet (MSDS) must be included with the returned materials. An MSDS is required by law to be available to people exposed to specific hazardous substances.

1.7 Storage and transport

Store and transport the device only in its original packaging. Technical data specifies the environmental conditions for storage and transport.

Related information

Technical data
Signal input and signal conditioning
Analog outputs
Pulse outputs
Digital inputs
Function outputs and Channel OK output
Relay outputs
Communication interfaces
Power supply
Tolerances and Response times
Environmental conditions and mechanical design

1.8 Disposal of the device

Provided that no repurchase or disposal agreement exists, recycle the following components at appropriate facilities:

- Recyclable metal
- Plastic elements

Sort the remaining components for disposal, based on their condition. National laws or provisions on waste disposal and protection of the environment apply.

Note
Environmental hazards! Electrical waste and electronic components are subject to treatment as special waste and may only be disposed by approved specialized companies.

1.9 CSA Certification

AMS 6300 SIS systems with backplane (A6371/00 or A6371/10) revision 10 or higher are, according to IEC 61010-1, CSA approved and marked on the backplane with the following label.

Figure 1-1: CSA Label

The equipment is supplied by a certified power source which is approved in accordance to IEC 60950-1 or IEC 61010-1. The DC output of this separately certified power source shall be below the limits of clause 6.3.1 and 9.4 of IEC 61010-1:2010.

External circuits of relay outputs shall be separated by at least basic insulation. External relay circuits are only intended for connection to voltage levels not exceeding 48 V AC / 4 A or 30 V DC / 4 A and shall be fused externally to exclude occurrence of higher currents.

Suitable external cords shall be used in the end application and shall be according local rules/standards for relay outputs.

The product is only to be installed into metal enclosure with 19" module frames or larger frames with adequate mechanical strength covering all electrical circuits and parts (open-type equipment according to IEC 61010-2-201:2013). This metal enclosure is required to serve as fire enclosure as well as protection against mechanical stresses and electric shock.

Ensure an adequate ventilation space so that heat does not build up. The ventilation space must be at least 1 RU (13/4 inch; 44.45 mm) in all directions.

No cooling fan is required for ambient temperatures up to +55°C. Above ambient temperatures of +55°C up to +65°C cooling fan is required. This cooling fan shall be separately approved according to relevant local (national or regional) requirements and fulfil the airflow requirements of 440 m^3/h.

Install cooling fan racks in between instead of the ventilation space when several units are mounted above each other in one cabinet. The necessary specifications for cooling fan racks result from the environmental and sitting criterions of the cabinet and cannot be defined generally.

As disconnecting device – required by clause 6.11 of IEC 61010-1:2010 – has to be provided, the power supply disconnecting device or interrupt facility may be used.

If at any time there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.

In combination with a certified external fuse or circuit breaker (see Power supply connection) that shall be used with these devices, all devices are considered to fulfil the requirements of a limited energy source to clause 9.4 of IEC 61010-1:2010.

1.10 China RoHS Compliance

Our products manufactured later than June 30, 2016 and those which are sold in the People's Republic of China are marked with one of the following two logos to indicate the Environmental Friendly Use Period in which it can be used safely under normal operating conditions.

Products without below mentioned marking are either manufactured before June 30 or are non-electrical equipment products (EEP).

Circling arrow symbol with "e": The product contains no hazardous substances over the Maximum Concentration Value and it has an indefinite Environmental Friendly Use Period.

Circling arrow symbol with a number: This product contains certain hazardous substances over the Maximum Concentration Value and it can be used safely under normal operating conditions for the number of years indicated in the symbol. The names and contents of hazardous substances can be found in the folder "China RoHS Compliance Certificates" on the documentation CD or DVD enclosed with the product.

2 Safety instructions

To ensure safe operation, carefully observe all instructions in this manual.

The correct and safe use of this device requires that operating and service personnel both understand and comply with general safety guidelines and observe the special safety comments listed in this manual. Where necessary, safety-sensitive points on the device are marked.

⚠ DANGER

Because the device is electrical equipment, commissioning and service must be performed only by trained and authorized personnel. Maintenance must be carried out only by trained, specialized, and experienced personnel.

2.1 Using the device

Install and use the device as specified in this manual.

If the device is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

2.2 Functional safety

With safety function "Overspeed Protection" the AMS 6300 SIS protection system meets the requirements for SIL 3 according to IEC 61508 and relevant parts of DIN EN 61511-1:2019-02 and DIN EN 62061. With safety function "Protection against wrong rotational direction" the AMS 6300 SIS meets the requirements for SIL 2 according to IEC 61508 and relevant parts of DIN EN 61511-1:2019-02 and DIN EN 62061.

Note

Any safety relevant information, characteristics and requirements to meet and preserve the functional safety according to IEC 61508 are exclusively contained in safety manual "Safety Manual AMS 6300 SIS".

2.3 Power supply

Supply the AMS 6300 SIS with safety low voltage (24 V). For this reason, a separate power supply unit is required that meets the requirements SELV / PELV or the directive for equipment EN 60950-1. Any interface of the AMS 6300 SIS may only be connected to external devices that meet these requirements. Consider that in case of faults the supply voltage for the measuring chain must be limited to a maximum value of 48 V (only if using eddy-current or Hall effect sensor).

2.4 Owner's responsibility

If there is a reason to suspect that hazard-free operation, and thus, adequate machine protection is no longer possible, take the device out of operation and safeguard it from unintentional operation. This is the case:

- if the device shows visible damage.
- if the device no longer works.
- after any kind of overload that has exceeded the permissible limits (such as those detailed in chapter "Technical data," section "Environmental conditions").

⚠ DANGER

If device tests have to be completed during operation or if the device has to be replaced or decommissioned, it will impair the machine protection and may cause the machine to shut down. Make sure to deactivate machine protection before starting such work, and reactivate it after work has been completed.

Related information

Technical data
Signal input and signal conditioning
Analog outputs
Pulse outputs
Digital inputs
Function outputs and Channel OK output
Relay outputs
Communication interfaces
Power supply
Tolerances and Response times
Environmental conditions and mechanical design

2.5 Radio interference

The device is carefully shielded and tested to be technically immune to radio interference and it satisfies the standards in accordance with IEC 613261, IEC 6132631, and DIN EN55011 class A. If you operate this device together with other peripheral devices that are not properly shielded against radio interference, disturbances and radio interferences may occur. This may require special measures for interference suppression.

Note
Devices of class A are designed for the use in industrial environments.

2.6 ESD safety

⚠ DANGER

Internal components can be damaged or destroyed due to electrostatic discharge (ESD) during the handling of the device.

Take suitable precautions before handling the device to prevent electrostatic discharges through the electronics. Such measures might include, for example, wearing an ESD bracelet. Transport and storage of electronic components may only be made in ESD-safe packaging.

Handle the device with particular care during dry meteorological conditions with relative humidity below 30% as electrostatic discharges can appear more frequently.

3 Application and design

3.1 Application

The AMS 6300 SIS Overspeed Protection System serves the measurement of rotational speed and the detection of the rotational direction at rotating machinery to protect the machine against overspeed and startup with wrong direction of rotation. The AMS 6300 SIS is designed for the connection of eddy current measuring chains consisting, for example, of signal converter CON 011 and sensor PR 6423/xxxxxx, Hall effect sensors such as PR 9376, and VR sensors (variable reluctance sensors). With the consistent three channel design, starting with the signal acquisition up to the evaluation of the measured rotational speed, the system offers the maximum safety and availability for the machines to be monitored.

The basis of this protection system is made up of three A6370 speed monitors. The backplane as the rear of a system frame provides all electric connections and interconnections between the monitors.

Each of the microprocessor-controlled monitors measures the machine speed with a single channel with an eddy current measuring chain, Hall effect sensor, or VR sensor. The required voltage supply for the sensors is provided by the A6370.

The received signal pulses are internally preprocessed for further signal processing and output for the use in external devices. The number of teeth of the trigger wheel and the machine speed define the signal frequency and thus the speed-proportional characteristic value. The calculated characteristic value is output through two current outputs 0/4 to 20 mA.

The interconnection between the monitors through the backplane permits the comparison of measuring results and status conditions of the AMS 6300 SIS monitors. Each of the monitors can compare all speed values of all monitors referring to tolerances.

The configuration of the speed monitors A6370 requires a computer with installed AMS 6300 Configuration software . The connection between computer and monitor is made through the USB interface at the monitor front. The required interface cable is part of the A6910 Configuration Kit. An additional RS 485 bus interface at the rear terminal strip or a PROFIBUS interface connector at the monitor front (optional) permit the transmission of measuring data, for example, to host computers.

The manual at hand describes the functions of the entire AMS 6300 SIS including all components. This operating manual refers to the AMS 6300 SIS versions and revision levels as shown in Table 3-1.

Table 3-1: Hardware and software revision levels

Component	Type designation	Hardware revision level	Firmware- / Software version
Monitor	A6370 D (Display)	10, 11, or 12	Firmware Safe-µC 2.00[1] Firmware Sub-µC 2.00[1]

Table 3-1: Hardware and software revision levels *(continued)*

Component	Type designation	Hardware revision level	Firmware- / Software version
	A6370 D/DP (Display + Profibus)	10, 11, or 12	Firmware Safe-µC 2.00[1] Firmware Sub-µC 2.00[1]
Backplane	A6371/00 (Trip Voted)	10, 11, or 12	N/A
	A6371/10 (Trip Not Voted)	10, 11, or 12	N/A
Configuration software	AMS 6300 Configuration	N/A	1.10

1 *Overall version: 2.00 (indicated by the monitor display at the system start-up)*

Note

Mixed operation of monitors with different firmware versions within a system.
There are three firmware variants for the monitors A6370D and A6370D/DP:

The overall firmware version 1.02 consists of the single versions 1.00 for the Safe-µC and 1.02 for the Sub-µC.

The overall firmware version 1.04 consists of the single versions 1.01 for the Safe-µC and 1.03 for the Sub-µC.

The overall firmware version 2.00 consists of the single versions 2.00 for the Safe-µC and 2.00 for the Sub-µC.

The mixed operation of monitors with different firmware versions within a system is generally permitted. Emerson recommends the use of the latest firmware version.

3.2 System design

3.2.1 Components

The AMS 6300 SIS Overspeed Protection System consists of a number of components. Table 3-2 shows an overview of system components available. With these components it is possible to configure two types of Overspeed Protection Systems, "AMS 6300 SIS Trip not voted" and "AMS 6300 SIS Trip voted". For the configuration of a system AMS 6300 SIS "Trip not voted" the components as shown in Table 3-3 and for the configuration of a system AMS 6300 SIS "Trip voted" the components as shown in Table 3-4 are required. The software AMS 6300 Configuration and the configuration cable are needed for both systems (Trip voted or Trip not voted).

Table 3-2: System components

Component	Type	Description
Monitor	A6370 D	Monitor with display
	A6370 D/DP	Monitor with display and Profibus connection

Table 3-2: System components *(continued)*

Component	Type	Description
Backplane	A6371/00	Trip Voted Trip Relay with 2 out of 3 logic
	A6371/10	Trip Not Voted Trip relay without majority voting
Module frame	A6352	19” module frame, 3RU
Terminal block	A6380	Sub-D Interface 9 pole
	A6381	Sub-D Interface 25 pole
Cables	A6384	Sub-D cable 9 pole, length: 1 m
	A6385	Sub-D cable 25 pole, length: 1 m
	A6386	Sub-D cable 9 pole, length: 3 m
	A6387	Sub-D cable 25 pole, length: 3 m
Configuration Kit	A6910	Cable for configuration of the monitors and CD with operating manual and link for downloading the configuration software.

Table 3-3: Components AMS 6300 SIS Trip Not Voted

Component	Type	Number
Monitors	A6370 D or A6370 D/DP[1]	3
Backplane	A6371/10	1
19” module frame or other frames	For example: A6352	1
Terminal block	A6380	3
	A6381	3
Cables	A6384 or A6386	3
	A6385 or A6387	3

1 *No mixed card types within a system.*

Table 3-4: Components AMS 6300 SIS Trip Voted

Component	Type	Number
Monitors	A6370 D or A6370 D/DP[1]	3
Backplane	A6371/00	1
19” module frame or other frames	For example: A6352	1
Terminal block	A6380	3

Table 3-4: Components AMS 6300 SIS Trip Voted *(continued)*

Component	Type	Number
	A6381	3
Cables	A6384 or A6386	3
	A6385 or A6387	3

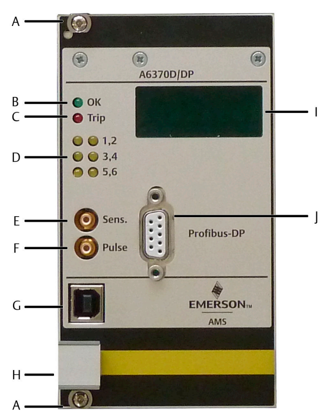
1 *No mixed card types within a system.*

3.2.2 Design

Speed monitor A6370

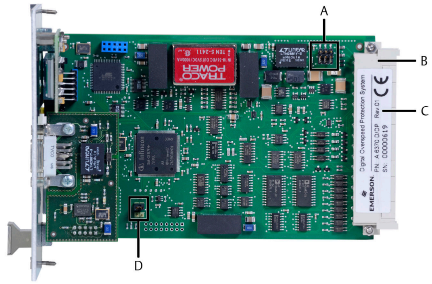
Speed monitors are designed as printed circuit boards in standard Euro format (100 mm x160 mm) with a 14RU anodized front panels (approximately 71 mm width). The Profibus connector on the front panel is optional. Figure 3-1 shows the elements of the front plate and Figure 3-2 the monitor side view.

Figure 3-1: Monitor - front view



A. *Mounting screws*
B. *Channel OK LED*
C. *Trip LED: Status Trip condition*
D. *Status Function outputs Output 1 – Output 6*
E. *Sensor signal socket, providing the absolute value of the decoupled and unfiltered raw signal of the measuring chain, amplitude: sensor signal multiplied by factor 0.15. No signal available when using VR sensors.*
F. *Pulse output, TTL signal based on measuring signal*
G. *Configuration interface*
H. *Handle for inserting and pulling the monitor*
I. *Display*
J. *Profibus DP connector (optional)*

Figure 3-2: Monitor - side view

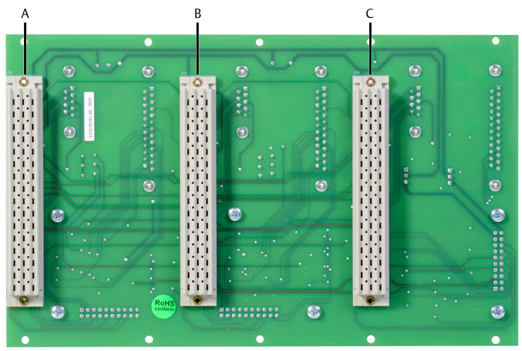


A. *Jumper [J1] RS 485 Bus configuration*
B. *F48 Plug connector*
C. *Type plate with type (PN), serial number (SN), and hardware revision (Rev.)*
D. *Boot jumper [J2] (has to be placed as shown in Figure 3-2)*

Backplane A6371/xx

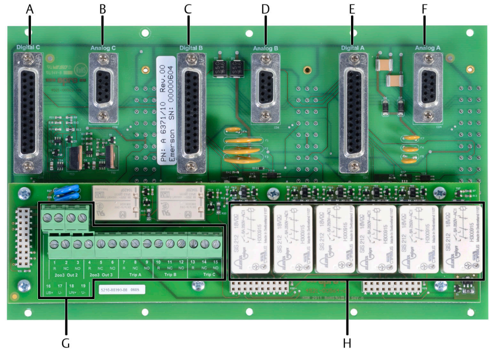
Figure 3-3 to Figure 3-5 show the design of the two backplane types. There are three F48 plug connectors for the speed monitors on the front of the backplane. For the connection of input and output signals, there are two Sub-D female connectors for each of the channels at the rear of the backplane. The analog signals which are sensor supply, sensor signal, and current outputs are connected to the three 9-pole Sub-D sockets named "Analog A", "Analog B", and "Analog C". The digital input and output signals such as RS 485 Bus connection, activation of test values, function outputs, and pulse outputs are connected to the three 25-pole Sub-D sockets named "Digital A", "Digital B", and "Digital C". Connection of the system power supply and the Trip or relay logic outputs are made to the terminal strip on the sandwich board.

Figure 3-3: Backplane Trip Not Voted and Trip Voted - front view



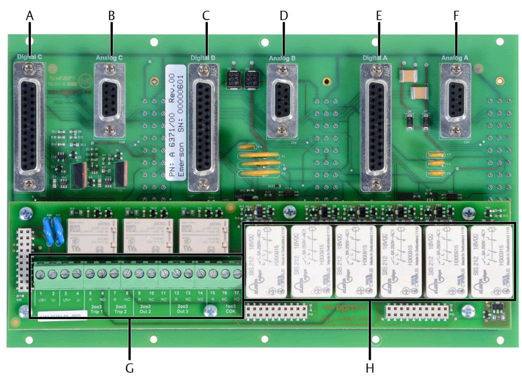
A. *F48 plugin place Monitor A*
B. *F48 plugin place Monitor B*
C. *F48 plugin place Monitor C*

Figure 3-4: Backplane Trip Not Voted - rear view



A. *Digital signals Monitor C*
B. *Analog signals Monitor C*
C. *Digital signals Monitor B*
D. *Analog signals Monitor B*
E. *Digital signals Monitor A*
F. *Analog signals Monitor A*
G. *Connection redundant system power supply and Trip logic relay*
H. *Sandwich board with relay logic Trip Not Voted*

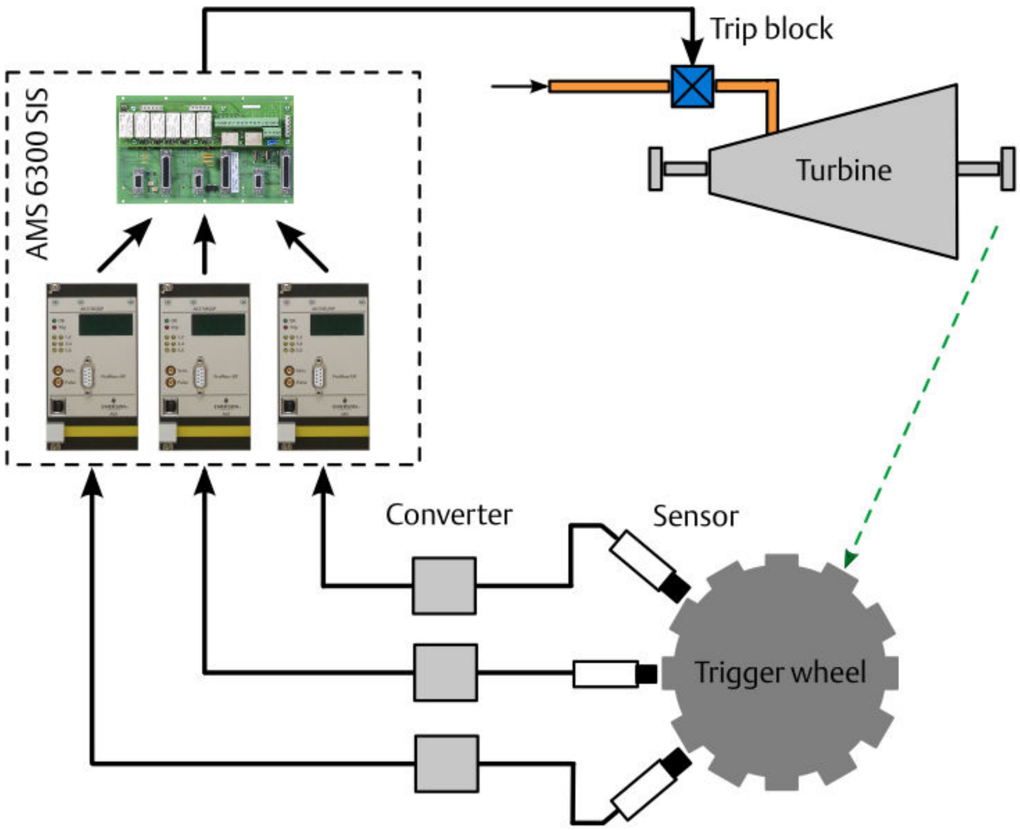
Figure 3-5: Backplane Trip Voted - rear view



A. *Digital signals Monitor C*
B. *Analog signals Monitor C*
C. *Digital signals Monitor B*
D. *Analog signals Monitor B*
E. *Digital signals Monitor A*
F. *Analog signals Monitor A*
G. *Connection of redundant system power supply and Trip logic relay*
H. *Sandwich board with relay logic Trip Voted*

Figure 3-6 shows a system overview including trigger wheel, sensors and protection system

Figure 3-6: Overview



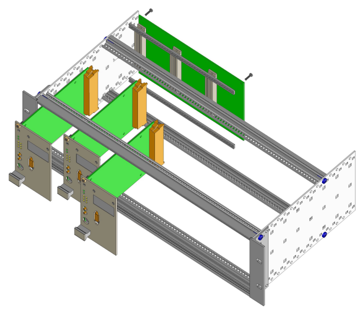
4 Installation and commissioning

This chapter describes mounting, installation, connection, and commissioning of the AMS 6300 SIS Overspeed Protection System and the requirements on the trigger wheel together with the required arrangement of the sensors at the trigger wheel.

4.1 Mounting of the system

The steps below describe the mounting of the AMS 6300 SIS system. Figure 4-1 shows the system assembly.

Figure 4-1: Assembly drawing



Prerequisites

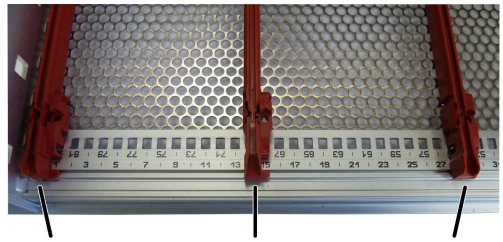
You will need the following equipment to assemble the rack and mount it in a cabinet:

- Philips screwdriver size PH1 for mounting the backplane
- Suitable Phillips screwdriver for mounting the System Rack with the cage nuts into the cabinet
- Suitable flathead screwdriver (for example 3.5 x 0.6 x 100 mm) for the terminal blocks

Procedure

1. If the A6371/xx backplane is not already screwed on the rear of the A6352 19" frame, mount the backplane with the enclosed mounting kit, consisting of two plastic rails and 10 assembly screws.
2. Mount the backplane as shown in Figure 4-1.
3. Check the position of the guide rails for the monitors. The rails have to be on position 1, 15, and 29 as shown in Figure 4-2.

Figure 4-2: Position guide rails



4. Mount the rack in a suitable housing or cabinet

Note
Be sure to account for the environmental condition, especially the environmental temperature for the AMS 6300 SIS. Install fan trays or other accommodations if necessary.

5. Mount (snap on) the terminal blocks for the connection of analog and digital input and output signals , see Figure 4-4 and Figure 4-5, on a suitable mounting rail (NS 35/7.5).
6. Make the connection between terminal blocks and backplane through the cables A6384 A6387. Emerson recommends using the prefabricated system cables. Identify the cables by the numbers printed on the connectors:
   - A6384: 23 05 570
   - A6385: 23 05 635
   - A6386: 23 05 596
   - A6387: 23 05 651
7. Install the three speed monitors in the rack and secure them by tightening the front-plate screws.

4.1.1 EMC-compliant installation

Observe the following points for an EMC compliant installation:

- The system must be installed in a suitable housing or control cubicle.
- The cable screens of the signal cables must be connected to earth potential at the cable inlet of the housing or control cubicle (see Figure 4-11).
- All electrical connections, except the power supply connection and the connections to the relay outputs (relay logic and trip relay), must be made by using screened cables.

4.1.2 Required mounting space

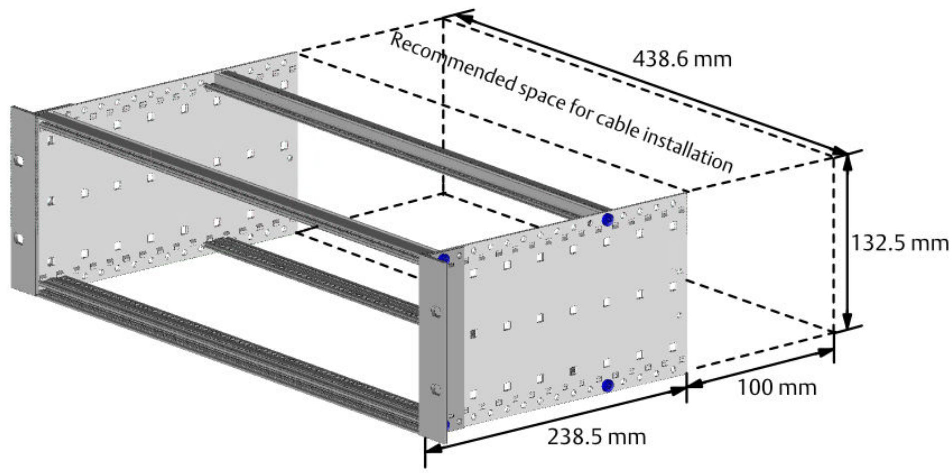
For the installation of the 19" rack A6352 and for the connection of the cables a mounting space as shown in Figure 4-3 is required.

The 9-pole and 25-pole Sub-D terminal blocks have the following dimensions:

- 9-pole terminal block A6380:
  W 34,7 mm x H 65,5 mm x D 45,1 mm
- 9-pole terminal block A6381:
  W 57,4 mm x H 69 mm x D 62 mm

The connection of each AMS 6300 SIS requires three 9-pole and three 25-pole terminal blocks. Mount them on a mounting rail of at least 277 mm length.

Figure 4-3: Required mounting space



4.2 Connection

Make the connection of input signals and power supply to the overspeed protection system through the terminal blocks A6380 and A6381 and through the backplane. The terminal blocks are provided with screw terminals and permit connection of cables with wire cross sections as shown in Table 4-1. Required stripped length of wire is 8mm.

Table 4-1: Wire cross section

Cable type	Wire cross section	
	Minimum	Maximum
Rigid cable	---	4 mm²
Flexible cable	0.2 mm²	2.5 mm²
AWG	24	12

For connection of measuring chains and control signals, Emerson recommends using a double screened cable with twisted cable pairs (for example LiYCY-CY 2x2x0.25 mm^2) to ensure the specification regarding EMC. Connect the outer cable shield to protective earth at the cable inlet of the control cubicle (see also Sensor connection). This applies also when using a 3-pole or 4-pole cable with only one cable shield.

The interface for signal control and configuration and the optional PROFIBUS interface are located on the front plate of the A6370 monitor.

4.2.1 Pin assignment backplane and terminal blocks

A6380 SubD interface, 9pole

Connect the analog input and output signals to the AMS 6300 SIS system through the A6380 terminal blocks and the corresponding cables A6384 or A6386. See Figure 4-4 and Table 4-2. Each of the three channels (A, B, and C) requires one of these terminal blocks.

Figure 4-4: A6380

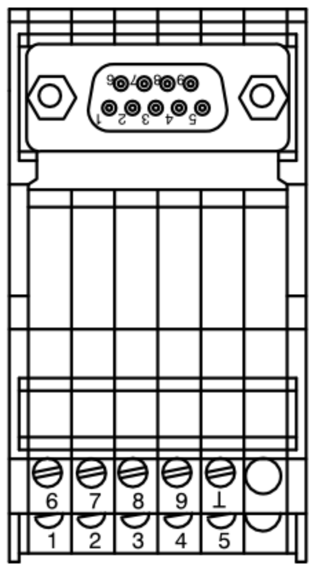


Table 4-2: Pin assignment A6380

Terminal	Designation	
1	SENS-SP-	Sensor supply (-)
2	SENS-IN-	Signal input (-)
3	GND	Ground
4	IOut1+	Current output 1 (+)
5	IOut2+	Current output 2 (+)
6	SENS-SP+	Sensor supply (+)
7	SENS-IN+	Signal input (+)
8	IOut1-	Current output 1 (-)
9	IOut2-	Current output 2 (-)
⊥	not used	

A6381 SubD interface, 25pole

Connect digital input and output signals to the AMS 6300 SIS system through the A6381 terminal blocks and the corresponding cables A6385 or A6387. See Figure 4-5 and Table 4-3. Each of the three channels (A, B, and C) requires one of these terminal blocks.

Figure 4-5: A6381

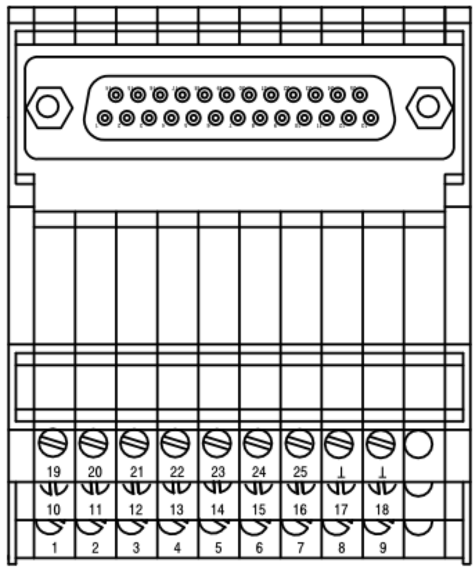


Table 4-3: Pin assignment A6381

Terminal	Designation	
1	GND (485)	Ground RS 485 Bus
2	A-485	A RS 485 Bus
3	GND(Inp)	Ground binary inputs
4	Res-Latch	Input Reset Latch
5	Prf1	Input Test value 1 activation
6	U-	Reference Digital outputs
7	COKBuf	Digital output Channel OK
8	Out2	Digital- / Function output 2
9	Out4	Digital- / Function output 4
10	Out6	Digital- / Function output 6
11	PulsOut-X-E	Emitter Pulse output 1
12	PulsOut-Y-E	Emitter Pulse output 2
13	PulsOut-Z-E	Emitter Pulse output 3
14	GND (485)	Ground RS 485 Bus
15	B-485	B RS 485 Bus

Table 4-3: Pin assignment A6381 *(continued)*

Terminal	Designation	
16	GND(Inp)	Ground binary inputs
17	Enable	Input Enable Test value
18	Prf2	Input Test value 2 activation
19	U-	Ground Digital outputs
20	Out1	Digital- / Function output 1
21	Out3	Digital- / Function output 3
22	Out5	Digital- / Function output 5
23	PulsOut-X-C	Collector Pulse output 1
24	PulsOut-Y-C	Collector Pulse output 2
25	PulsOut-Z-C	Collector Pulse output 3
⊥	Not used	
⊥	Not used	

A6371/00 Backplane 'Trip Voted'

Connect the outputs of the relay logic to the backplane terminal strip. The connection of the supply voltage for the overspeed protection system is also made through these terminal strip. See Figure 4-6 and Table 4-4

Figure 4-6: Terminal strip A6371/00

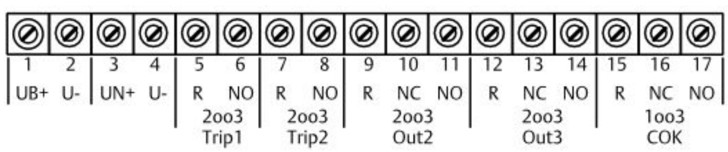


Table 4-4: Pin assignment A6371/00

Terminal	Designation	
1	UB+	Supply voltage + (redundant)
2	U-	Supply voltage (redundant)
3	UN+	Supply voltage + (redundant)
4	U-	Supply voltage (redundant)
5	R 2oo3 Trip 1	Changeover contact Trip Relay 1
6	NO 2oo3 Trip 1	Make contact Trip Relay 1
7	R 2oo3 Trip 2	Changeover contact Trip Relay 2
8	NO 2oo3 Trip 2	Make contact Trip Relay 2
9	R 2oo3 Out2	Changeover contact Relay Out 2

Table 4-4: Pin assignment A6371/00 *(continued)*

Terminal	Designation	
10	NC 2oo3 Out2	Break contact Relay Out 2
11	NO 2oo3 Out2	Make contact Relay Out 2
12	R 2oo3 Out3	Changeover contact Relay Out 3
13	NC 2oo3 Out3	Break contact Relay Out 3
14	NO 2oo3 Out3	Make contact Relay Out 3
15	R 1oo3 COK	Changeover contact Relay Channel Ok
16	NC 1oo3 COK	Break contact Relay Channel OK
17	NO 1oo3 COK	Make contact Relay Channel OK

4.2.2 A6371/10 Backplane 'Trip Not Voted'

Connect the outputs of the relay logic to the backplane terminal strip. Connection of the supply voltage for the overspeed protection system is also made through these terminal strip. See Figure 4-7 and Table 4-5.

Figure 4-7: Terminal strip A6371/10

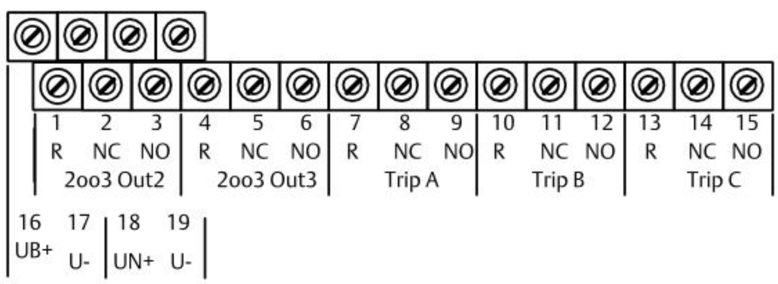


Table 4-5: Pin assignment A6371/10

Terminal	Designation	
1	R 2oo3 Out2	Changeover contact Relay Out 2
2	NC 2oo3 Out2	Break contact Relay Out 2
3	NO 2oo3 Out2	Make contact Relay Out 2
4	R 2oo3 Out3	Changeover contact Relay Out 3
5	NC 2oo3 Out3	Break contact Relay Out 3
6	NO 2oo3 Out3	Make contact Relay Out 3
7	R Trip A	Changeover contact Trip Relay A
8	NC Trip A	Break contact Trip Relay A
9	NO Trip A	Make contact Trip Relay A
10	R Trip B	Changeover contact Trip Relay B

Table 4-5: Pin assignment A6371/10 ***(continued)***

Terminal	Designation	
11	NC Trip B	Break contact Trip Relay B
12	NO Trip B	Make contact Trip Relay B
13	R Trip C	Changeover contact Trip Relay C
14	NC Trip C	Break contact Trip Relay C
15	NO Trip C	Make contact Trip Relay C
16	UB+	Supply voltage + (redundant)
17	U-	Supply voltage (redundant)
18	UN+	Supply voltage + (redundant)
19	U-	Supply voltage (redundant)

4.2.3 Power supply connection

See Table 4-4 for the terminal connection plan of backplane A6371/00 'Trip Voted'. Correspondingly, see Table 4-5 for the terminal connection plan of backplane A6371/10 'Trip not Voted'.

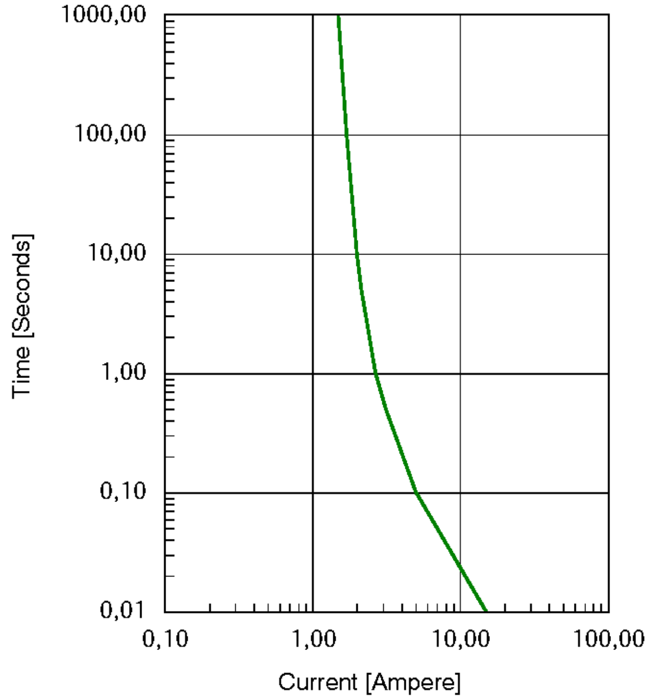
The operation of the AMS 6300 SIS requires the supply with a +24 V dc power supply according to SELV / PELV or the EN 609501 Directive for Office Machines with at least 30 W power capability. The permissible voltage range is +19 V to +31.2 V dc. If the supply voltage increases +33 V dc, the AMS 6300 SIS will disconnect the according supply line. Connection of supply voltage for the complete system inclusive measuring chains is made through connection terminals at the backplane. If required, the AMS 6300 SIS may also be supplied redundantly. For this purpose, the system has redundant supply inputs decoupled by diodes. With a redundant supply, the availability of the supply voltage can be ensured even when one supply input is disconnected, for example, due to over-voltage.

Note
The power supply for the monitors is electrically isolated from the remaining circuits on the card.

Dimensioning of the pre-fuse

The supply voltage circuit of the monitor A6730 is equipped with a permanently installed 1 A fuse. Figure 4-8 shows the typical time-current characteristic of this fuse. For example, the fuse trips at a current of 2 A after 10 seconds. Dimension a pre-fuse higher than the built-in fuse. In case of a monitor failure, the built-in fuse of the monitor should trips at first and then the pre-fuse as the whole AMS 6300 SIS system is equipped with one supply voltage. An appropriately dimensioned pre-fuse ensures the availability of the protection system in case of a monitor failure. The AMS 6300 SIS can be protected, for example, with a 4 A circuit breaker of type 1180-01-4A of the company E-T-A.

Figure 4-8: Typical time-current characteristic of the built-in fuse



4.2.4 Connection of Relay Logic and Trip Relay

See Table 4-4 for the terminal connection plan of backplane A6371/00 'Trip Voted'. Correspondingly, see Table 4-5 for the terminal connection plan of backplane A6371/10 'Trip not Voted'.

The combined logical signals are output through floating relay contacts at the backplane. Make the connection of trip relay and relay logic to the terminal strip on the sandwich board. Beside the output of individual function outputs through the terminal blocks for digital input and output signals, the AMS 6300 SIS provides the output of combined function outputs through the backplane. The possible signal combinations depend on the type of backplane and are shown below.

The allocation of the functions to function outputs is made with the configuration in tab **Digital Outputs** (see Digital Outputs).

For the maximum switching current of the relay contacts see Relay outputs.

Backplane A6371/00 'Trip Voted'

Signal combinations (see Figure 4-9):

Relay Logic 1: Trip 1 in "2 out of 3"

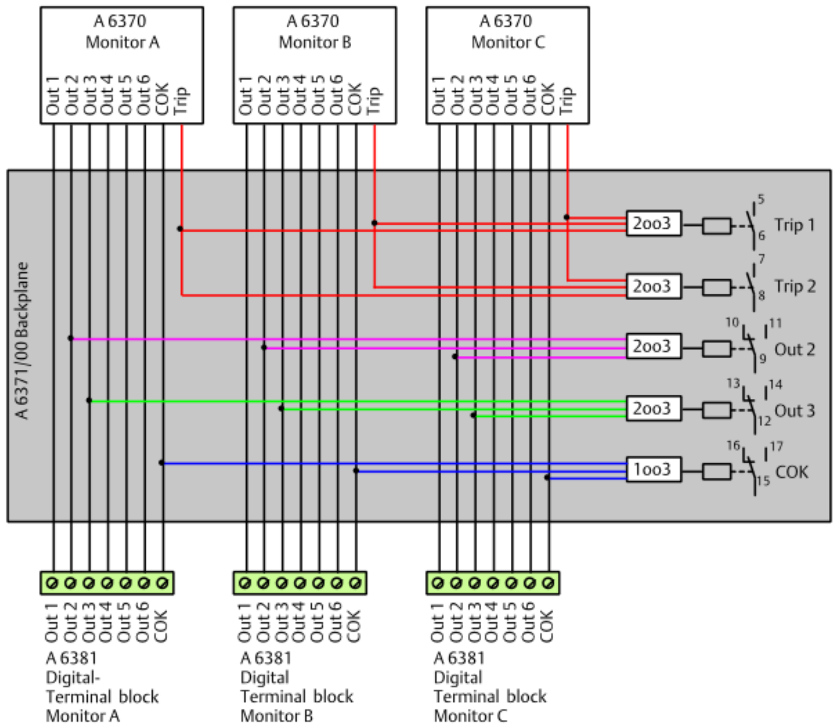
Relay Logic 2: Trip 2 in "2 out of 3"

Relay Logic 3: Function output 2 in "2 out of 3"

Relay Logic 4: Function output 3 in "2 out of 3"

Relay Logic 5: Channel OK in "1 out of 3"

Figure 4-9: Relay allocation 'Trip Voted'



Backplane A6371/10 'Trip Not Voted'

Signal combinations (see Figure 4-10):

Relay Logic 1: Function output 2 in "2 out of 3"

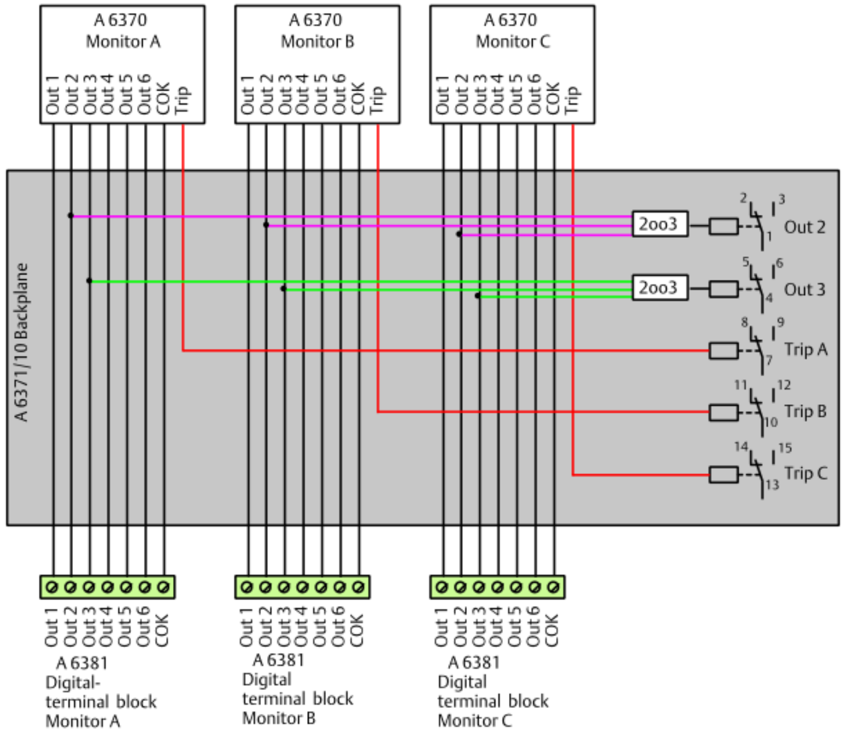
Relay Logic 2: Function output 3 in "2 out of 3"

Trip Relay 3: Trip A

Trip Relay 4: Trip B

Trip Relay 5: Trip C

Figure 4-10: Relay allocation 'Trip Not Voted'



4.2.5 Connection of analog signals

Connect the analog input and output signals through the 9-pole Sub-D terminal block A6380. Each monitor in the AMS 6300 SIS system is assigned to one 9-pole terminal block. See Table 4-2 for terminal connection plan of the terminal block A6380.

Sensor connection

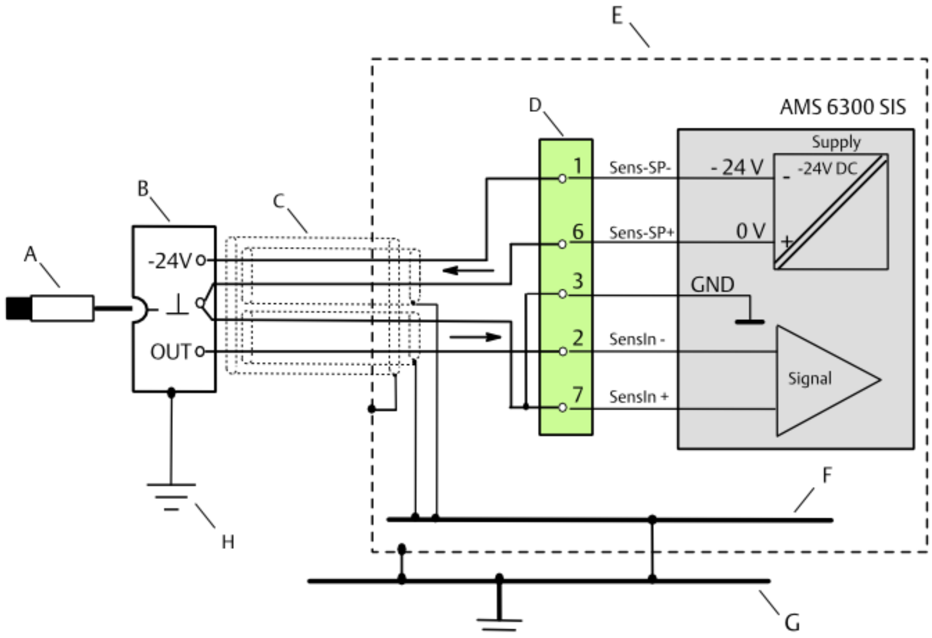
The AMS 6300 SIS is designed for the connection of eddy current measuring chains, Hall effect sensors, and VR sensors (variable reluctance sensors) (see terminal connection plan Table 4-2). A connected eddy current measuring chain or Hall effect sensor is supplied by the monitor with an electrically isolated supply voltage. The sensor supply has a current capability of maximum 35 mA. VR sensors do not require a voltage supply.

Eddy current sensor

Cable recommendation

To achieve undisturbed and proper measurements even with longer cables, Emerson recommends using cables of type LiYCY-CY 2x2x0.25mm^2. At distances greater than approximately 400 m between measuring chain and speed monitor, cables with bigger crosssections are recommended. Figure 4-11 shows the connection and an example for shielding and grounding of the cables.

Figure 4-11: Connection example with eddy current measuring chains



A. *Eddy current sensor PR 642x*
B. *Signal converter CON 0x1*
C. *Cable LIYCY-CY 2x2x0.25mm² (maximum 400 m)*
D. *9-pole sub-D terminal block monitor A, B, and C (analog signals)*
E. *Cabinet*
F. *Cabinet ground*
G. *Protective ground*
H. *Connection housing/protective ground (machine ground), only CON 011*

Hall effect sensor

Cable recommendation

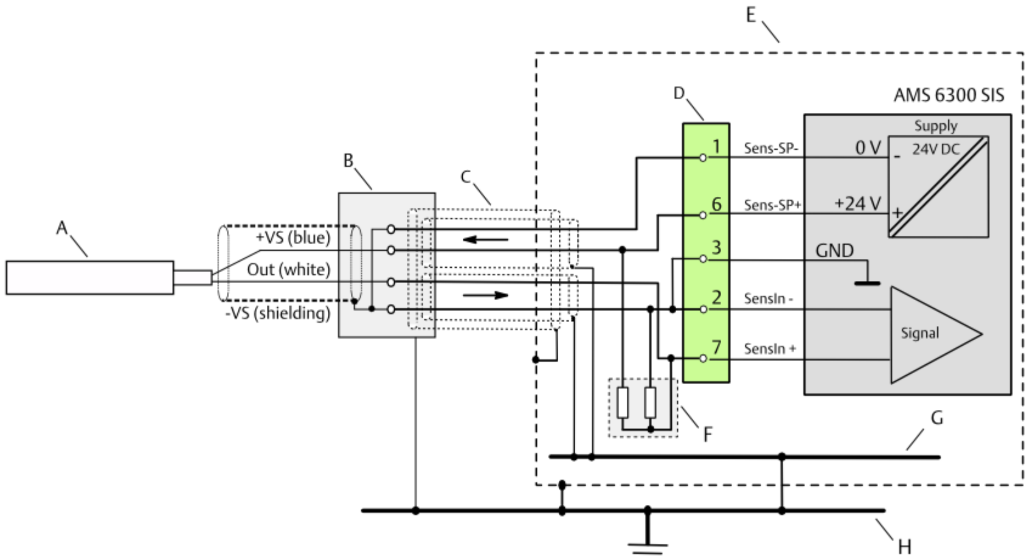
To achieve undisturbed and proper measurements even with longer cables, Emerson recommends using cables of type LiYCY-CY 2x2x0.25mm² between terminal box and AMS 6300 SIS. At distances greater than approximately 400 m between terminal box and AMS 6300 SIS, cables with bigger crosssections are recommended. Figure 4-12 shows the connection and an example for shielding and grounding of the cables.

Additional load resistors for Channel OK detection

To enable **Channel OK** detection at machine standstill if using PR 9376 Hall effect sensors, connect two 10 Ωk load resistors to the sensor input as shown in Figure 4-12.

Note
Connect the load resistors as close as possible to the signal input to ensure proper **Channel OK** detection.

Figure 4-12: Connection example with PR 9376 Hall effect sensor



A. *Hall effect sensor PR 9376*
B. *Terminal box*
C. *Cable LIYCY-CY 2x2x0.25mm^2 (maximum 400 m)*
D. *9-pole sub-D terminal block monitor A, B, and C (analog signals)*
E. *Cabinet*
F. *Load resistors for **Channel OK** detection*
G. *Cabinet ground*
H. *Protective ground*

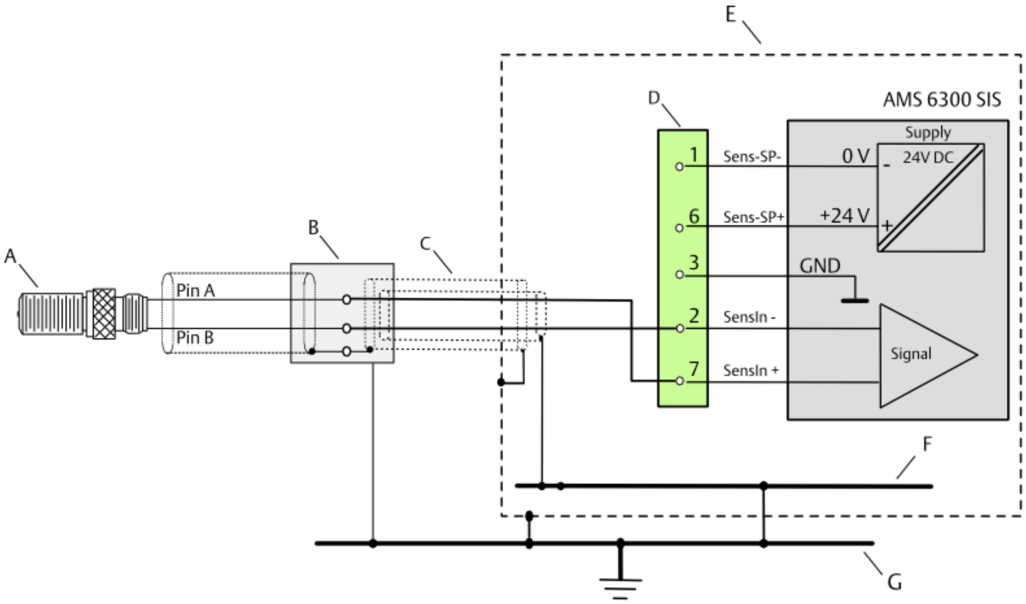
VR sensor (variable reluctance sensor)

Cable recommendation

To achieve undisturbed and proper measurements even with longer cables, Emerson recommends using cables of type LiYCY-CY 2x2x0.25mm^2 between terminal box and AMS 6300 SIS. At distances greater than approximately 400 m between terminal box and AMS 6300 SIS, cables with bigger crosssections are recommended. Figure 4-13 shows the connection and an example for shielding and grounding of the cables.

These kind of sensor types generally do not require a voltage supply.

Figure 4-13: Connection example with variable reluctance sensor

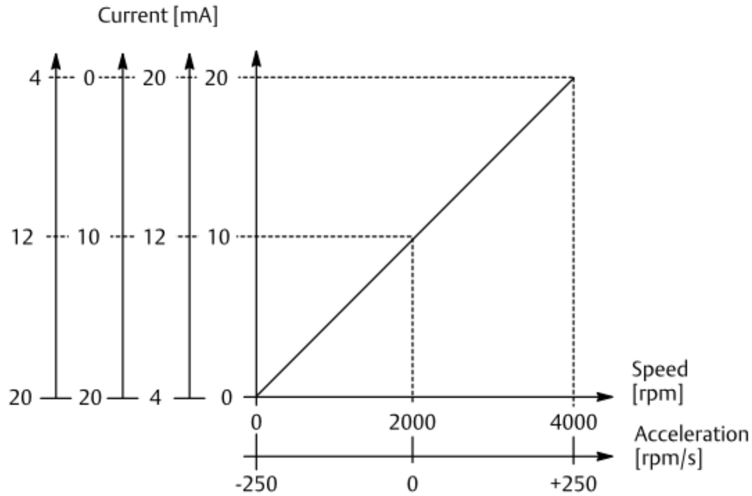


A. *Variable reluctance sensor (VR sensor)*
B. *Terminal box*
C. *Cable LIYCY-CY 2x2x0.25mm^2 (maximum 400 m)*
D. *9-pole sub-D terminal block monitor A, B, and C (analog signals)*
E. *Cabinet*
F. *Cabinet ground*
G. *Protective ground*

Current outputs

Each AMS 6300 SIS monitor is provided with two current outputs electrically isolated from the remaining monitor circuits. The outputs are not isolated to each other and are designed with a common ground connector (see Table 4-2 for terminal pins). Depending on the configuration, both current outputs provide constant currents with output ranges 0 to 20 mA, 4 to 20 mA, 20 to 0 mA, or 20 to 4 mA. The maximum burden for each of the outputs is 500 Ω. If output range 4 to 20 mA or 20 to 4 mA is selected, it is possible to switch the current to "0" in case of system faults - current suppression. Diagram Figure 4-14 shows the output current over the configured speed or acceleration range (see Analog Output 1 and Analog Output 2).

Figure 4-14: Example diagram current output



4.2.6 Connection of digital signals

Connect the digital input signals, the digital output signals, and the RS 485 Bus through the 25-pole Sub-D terminal block A6381. Each monitor in the AMS 6300 SIS system is assigned to one 25-pole terminal block.

Table 4-3 shows the terminal connection plan of the terminal block A6381.

RS 485 Bus

Use the RS 485 bus interface for the connection to external computers for transmitting measuring data. The RS 485 bus connections of the three monitors are interconnected through the backplane A6371. The RS 485 bus may be connected to any of the three digital terminal blocks (see Table 4-3 and diagram Figure 4-16). The communication through the RS 485 bus requires an additional interface card such as the A6825.

Note
The configuration of A6370 monitors through the RS 485 Bus is not possible.

Follow the steps to commission the RS 485 bus communication:

1. Connect the bus to the AMS 6300 SIS.
2. Set the bus termination at the monitor (see RS 485 Bus termination).
3. Set the RS 485 bus address (see Monitor, **Set Communication parameter**)
4. Set the transmission speed in the monitor (see Monitor, **Set Communication parameter**).
5. Set the communication interface at the computer (see Monitor).

See operating manual of the used interface converter for bus termination settings.

Setting RS 485 address

Before operating the RS 485 bus, assign a device address at the range of 1 to 255 to each monitor (AMS 6300 Configuration software: **Monitor → Set communication parameter**). Up to 31 devices can be connected to one RS 485 bus.

Upon delivery, the RS 485 address of all AMS 6300 SIS monitors is set to 255.

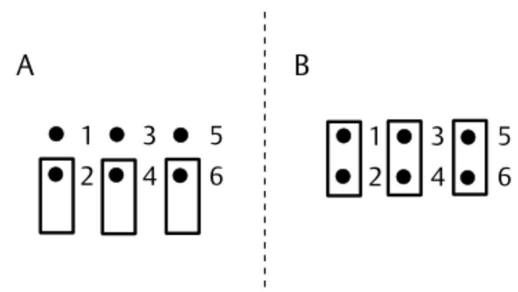
RS 485 Bus termination

The operation of the RS 485 bus requires electrical terminations at the first and last device of the bus. Install a 120 Ω termination resistor between lines A and B at the computer (or interface converter) and at the (physically) last device of the bus.

Additionally, connect line "A" to +5 V through a pull-up resistor and line "B"“ to ground through a pull-down resistor at one point of the bus. Therefore use the jumpers located on the board directly beside the terminal strip (see Figure 3-2). With open jumpers (position "off"), the bus lines are open and without termination.

To activate the bus termination and to initiate the references between "A" and +5 V and "B" and GND, you have to set the jumpers as shown in Figure 4-15 B). Figure 4-15 A) shows the jumper position for a deactivated bus termination and open references (delivery state).

Figure 4-15: Jumper settings

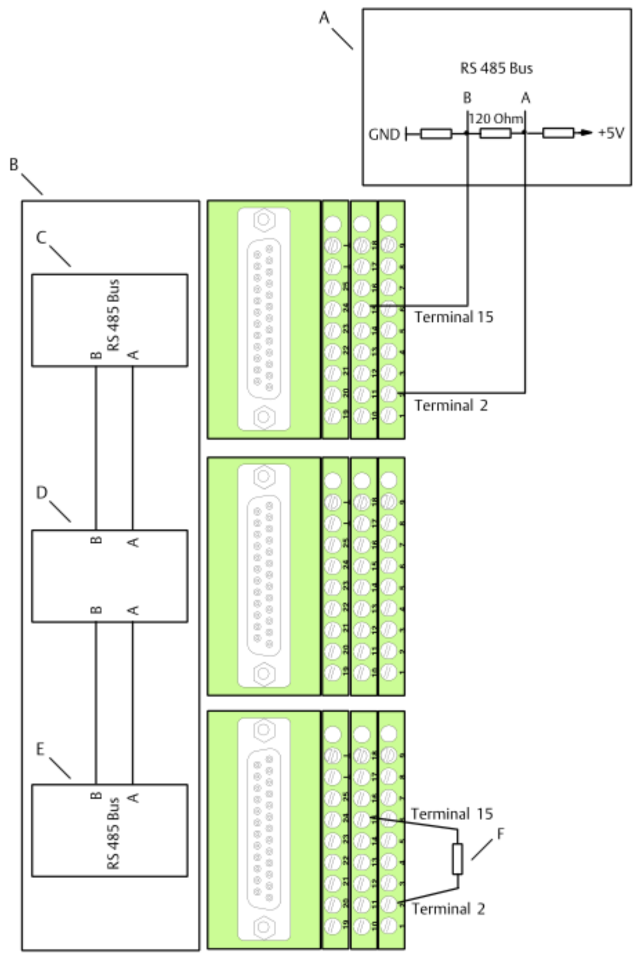


A. Deactivated bus termination (delivery state)
B. Activated bus termination

- 1 – 2 closed: Line B to GND through a resistor
- 3 – 4 closed: Line termination resistor 120 Ω between lines A and B
- 5 – 6 closed: Line A to +5 V through a resistor

Figure 4-16 shows an example whereat the jumpers for the bus configuration are open at the three monitors. The RS485 bus is interconnected through the backplane.

Figure 4-16: Connection diagram with external bus termination



A. *Interface converter*
B. *Backplane*
C. *Monitor A*
D. *Monitor B*
E. *Monitor C*
F. *120 Ω bus termination*

Note

To preserve the functionality of the RS 485 bus in case of a card exchange, transfer the positions of the jumpers to the new monitor.
Alternatively, make the bus termination with a 120 Ω resistor between pins 2 (RS 485 A) and 15 (RS 485 B) of the digital terminal block of the last monitor connected to the bus. This has the advantage of maintaining the bus termination in case of card exchanges (see Figure 4-16).

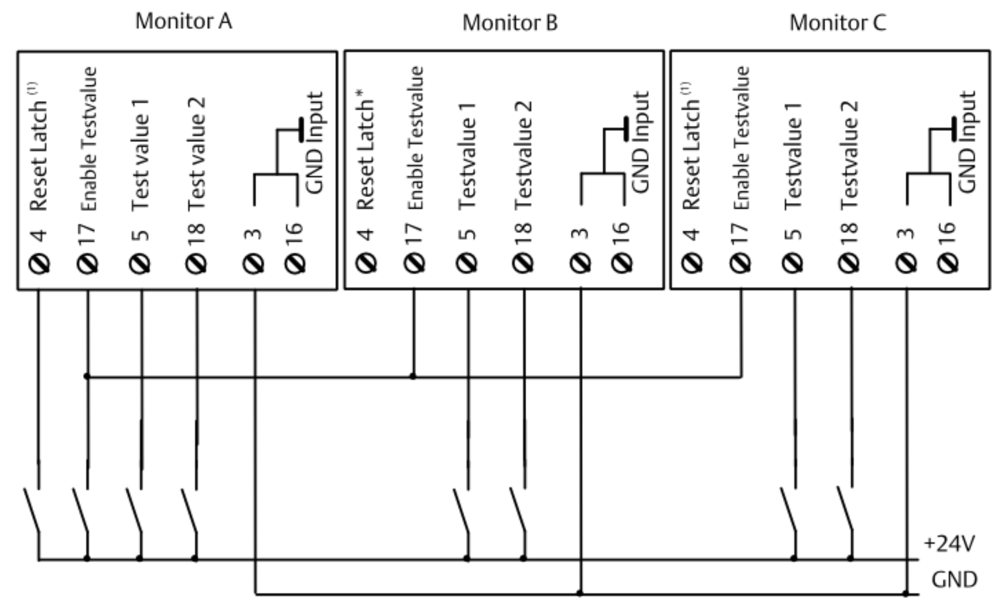
Digital inputs

Each monitor is provided with four electrically isolated digital inputs to enable and activate the test values and to reset latched alarm outputs (see Table 4-3).

A digital input signal with a voltage level between 13 V and 31 V is considered as "High" signal. A "High" signal will activate the function of the corresponding input. A digital input signal with a voltage level in the range 0 to +5 V is considered to be a "Low" signal. With a "Low" signal at the input, the corresponding input will be in the initial state.

Terminals 3 and 16 are common reference points of the inputs. Figure 4-17 shows a connection example.

Figure 4-17: Connection example digital inputs



(1) The digital **Reset Latch** inputs of the three monitors are interconnected through the backplane.

Reset Latch

Use this input to reset latched alarms and to reset the indicated rotational direction. Before using this input for reset of the rotational direction, activate this function with the AMS 6300 Configuration software (see Group Measuring functions). The **Reset Latch** input does only react on an input pulse. This pulse must have a duration of at least 100 ms before it is accepted from the monitor.

The **Reset Latch** inputs of the three monitors are interconnected through the backplane. Therefore it is sufficient to connect **Reset Latch** to one of the three terminal blocks of the system (see Figure 4-17).

Test Enable

Use this input to enable the test function. For the external activation of the configured test value Test 1 or Test 2, it is necessary to enable the test value by this input.

Test value 1

Use this input to activate Test value 1. A "High" signal at this input activates Test value 1 defined in tab **Test** (see Test). See Test values for further information about the test values.

Test value 2

Use this input to activate Test value 2. A "High" signal at this input activates Test value 2 defined in tab **Test** (see Test). See Test values for further information about the test values.

⚠ CAUTION

An activated test value replaces the measuring values.
To avoid an unintentional trip during the ongoing operation, ensure that at the same time not more than one monitor has an activated "Test value" ≥ "Trip limit value". Deactivate the test value and reset the trip message of the previously tested monitor before starting to test the next monitor.

If another monitor detects a disturbance or an overspeed while testing a monitor with "Test value" ≥ "Trip limit value" the machine will be tripped.

Note
As long as the "Test value" is below the current speed value, the overspeed protection function remains active.

Channel OK and function outputs

Each monitor has 6 function outputs and one **Channel OK** output (see Table 4-3 for connection). These +24 V voltage outputs are short-circuit proof and electrically isolated from the monitor circuits. The voltage level for "Low" signals is 0 V. The voltage level for "High" signals is 2 V below the system supply voltage. The maximum permissible output current is 25 mA for each of the outputs. Terminals 6 and 19 are common reference points of the outputs.

Function outputs

Use the configuration software to assign different functions to the digital outputs OUT1 to OUT6 (see Digital Outputs). Also define the operating principle of the outputs during the configuration. Select between **Open-circuit mode** and **Closed-circuit mode**.

In operating principle "Open-circuit mode", the active state shows a "High" signal (+24 V) at the digital output and the passive state a "Low" signal (0 V).

In operating principle "Closed-circuit mode", the active state shows a "Low" signal (0 V) at the digital output and the passive state a "High" signal (+24 V).

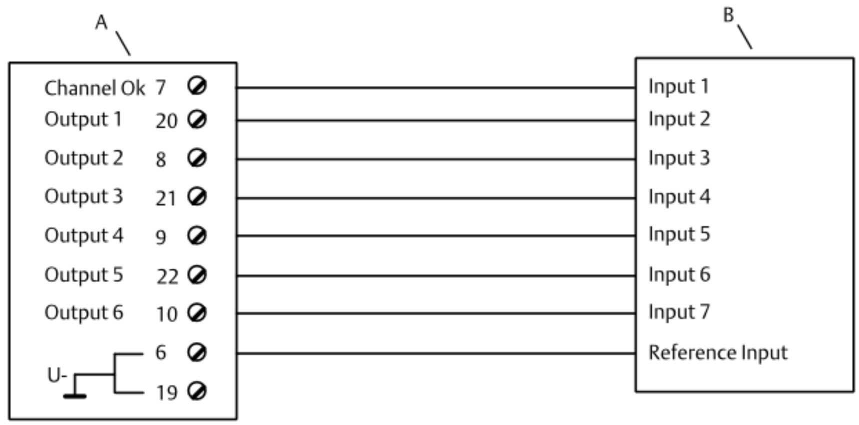
Channel OK output

Output **Channel OK** shows the condition of the monitor and the connected sensor. As long as the system supervision function has not detected a system fault, the **Channel OK** output is in the initial state and the corresponding LED **OK** at the monitor front is switched on.

In case of a system fault the **Channel OK** state of the monitor is switched off. This is indicated by the output.

Select the operating mode (open-circuit mode or closed-circuit mode) for the **Channel OK** output during the monitor configuration (see Group Output functions).

Figure 4-18: Connection example function outputs



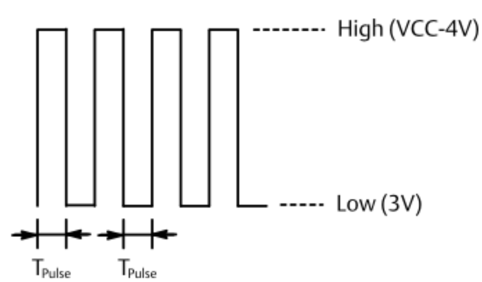
A. *Monitor A, B, or C*
B. *PLC*

Pulse outputs

The speed monitors are equipped with pulse outputs to supply external systems with pulses (see Table 4-3 connection). The pulse outputs provide signal pulses with the same frequency as the measured input signal.

Each speed monitor has three (X, Y, and Z) collector emitter paths (pulse outputs), electrically isolated from each other and from the remaining circuits of the AMS 6300 SIS. They are connected through the corresponding digital terminal block. An external supply is required for operating a pulse output. Connect the external supply as shown in Figure 4-21. The output pulses have voltage levels of VCC-4 V (see Figure 4-19).

Figure 4-19: Pulse



Switching Voltage VCC = 24 V

As the pulse outputs are collector-emitter paths, a minimum load is required to achieve a sufficient interpulse period T_{Pause} and thus a proper switching process of the output. Generally, the load resistance corresponds to the input impedance of a pulse input circuit and depends on the interpulse period T_{Pause}. Figure 4-20 shows the maximum resistance

R_{max} depending on the interpulse period. Use the following formula to calculate the interpulse period from the signal frequency f_{Input}.

$T_{Pause} = 1/2f_{Input}$

Example with input signal frequency f_{Input} = 1600 Hz:

T_{Pause} = 1/2*1600 Hz = 0.0003125s = 0.3125 ms

Use the diagram in Figure 4-20 to determine the maximum input resistance with the calculated interpulse period . A interpulse period of T_{Pause} = 0.3125 ms results in a maximum resistance of 50000 Ω. If the actual input resistance R_i should be greater, correct it by switching another resistance $R_{Parallel}$ in parallel to the input (see Figure 4-21). Calculate such parallel resistance with the following formula:

$R_{Parallel} = 1/((1/R_{max}) - (1/R_i))$

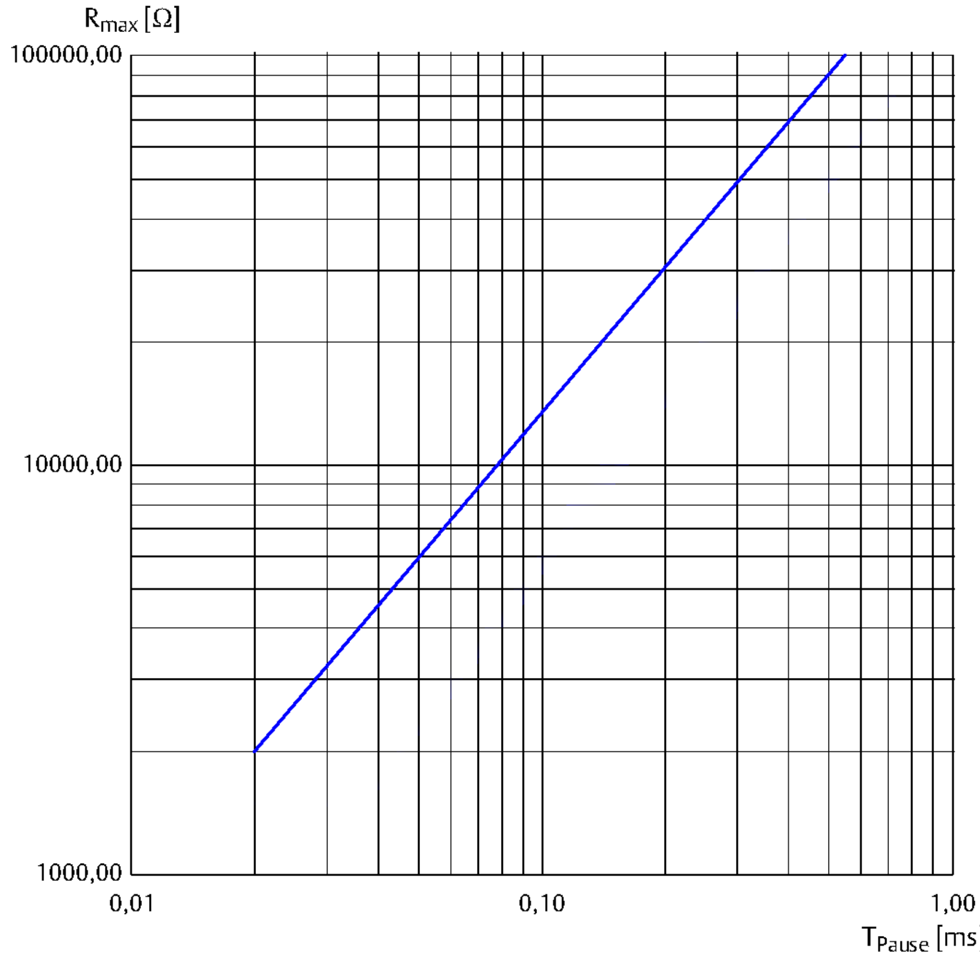
Example with R_{max} = 50000 Ω and R_i = 100000 Ω:

$R_{Parallel}$ = 1/((1/50000 Ω) - (1/100000 Ω)) = 100000 Ω

To meet the requirements for the input resistance from the example above, connect a resistance of approximately 100000 Ω in parallel to a pulse input with an input resistance R_i = 100000 Ω. So, the total resistance is reduced to approximately 50000 Ω.

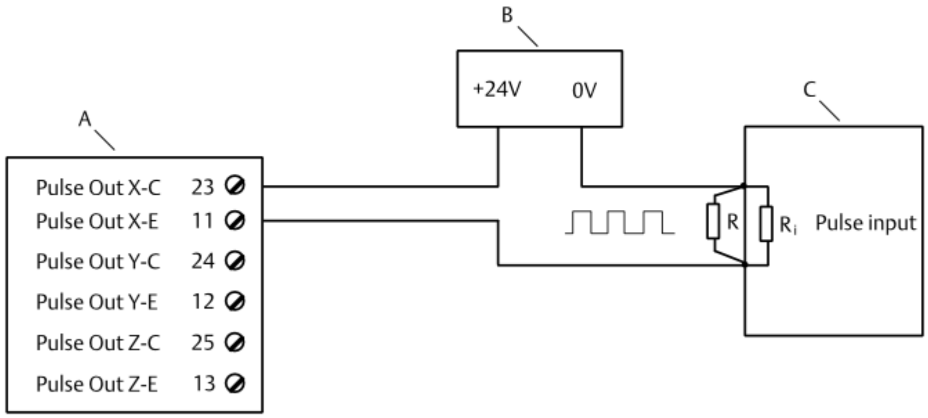
The typical minimum input resistance is about 2000 Ω.

Figure 4-20: Pulse/pause depending on the maximum load resistance



The output current of the pulse outputs are limited to 16 mA at an environmental temperature of 25°C. The cable capacity has an influence on the pulse duration. So the maximum cable length depends on the maximum output frequency and the resistance values from the diagram above. By using cables of type LiYCY-CY the maximum cable length is approximately 8 m.

Figure 4-21: Connection example pulse output X



R_i = approximately 2000 Ω to R_{max} (see Figure 4-20)

$R_{Parallel}$ = xxx (optional, if R_i is to high)

A. Monitor A, B, or C (terminal block A6381)
B. External DC voltage supply
C. Control system

4.2.7 USB configuration Interface

The USB interface is used for the configuration of the A6370 monitors, the indication of measuring data, and monitor status information. The electrically isolated interface socket is located on the front plate of the monitor. The USB 2.0 interface has a type B socket. The maximal cable length is 5 m. It is not necessary to install a driver for the USB interface. The required driver is already part of the operating system Microsoft Windows 7 or of higher versions.

4.2.8 SMB Front sockets

Note
The ground connections of sockets **Sens.** and **Pulse** are connected to the system ground of the monitor.

Socket Sens.

Socket **Sens.** on the front plate of the speed monitors provides the attenuated raw signal of the connected sensor. This signal is unfiltered, decoupled, open circuit, and short-circuit proof and serves the check of the connected sensor including the wiring. The signal U_{Sens} at this socket is the absolute value of the input signal and has an amplitude of:

$U_{Sens} = U_{Out_{Sensor}} * 0.15$

The required measuring cables with BNC SMB adapters are included in the A6910 Configuration Kit.

Note
There is no signal at this socket if a VR sensor is used.

Socket Pulse

Based on the sensor input signal and the configured trigger thresholds the card generates a TTL signal (0 to 5 V). This signal is needed for any further function of the AMS 6300 SIS and can be tapped for test purposes and fault finding at the mini SMB socket **Pulse** at the monitor front. The signal is nonreactive and the frequency corresponds to the frequency of the measured input signal. The required cables are included in the A6910 Configuration Kit.

4.2.9 Profibus DP V0 (optional)

This interface bus is optional and only available at the A6370 D/DP monitors. This interface bus permits a host computer to read measuring data from the module for further processing. The addition "DP" means "Decentralized Periphery". Connection is made through the 9-pole standard Profibus-DP socket at the monitor front.

Installation and Commissioning

The PROFIBUS-DP permits connection of up to 31 slave devices to the master.

The RS 485 address, adjusted during configuration with AMS 6300 Configuration (**Monitor → Set communication parameter**) is the same address as used for PROFIBUS-DP communications, beside this there are no settings required.

If an address change is necessary, power the respective monitor off and on again after the change to enable the address change for the PROFIBUS communication. This can be done, for example, by pulling out and plugging in the monitor.

Use the pre-assembled cable A6363 to connect the monitors to the PROFIBUS-DP. The cable length is 4 m with a PROFIBUS-DP connector on either side.

The operation of the PROFIBUS requires electrical terminations at the first and last device of the bus. The switches at the connectors serve the activation of a terminating resistor. For the activation set the switches to "On" (see Figure 4-22).

For the operation of the AMS 6300 SIS monitors through the PROFIBUS-DP connect the cable to the host computer (master). The necessary file with the Device Master Data (GSD) for the AMS 6300 SIS monitors can be found, after installation of the configuration software, in the folder **PROFIBUS_GSD** of the installation directory. As soon as the monitor is switched on and it receives telegrams through the bus, these are carried out by the processor, evaluated, and the data returned to the master.

Figure 4-22: Profibus connector

Switch ON = bus termination active

Switch OFF = no bus termination

PROFIBUS-DP, Table of Transmission and Received Bytes

The transmission of data via the PROFIBUS-DP is character-oriented. Data transmission runs in form of data blocks, that means in sequences of characters. The table below shows transmission and receive bytes and their meaning.

Table 4-6: Profibus table

Parameter No.	Byte No.	Type	Byte / Bit position	Output / Input	Function	Measuring unit
1	1	uint32[1]	LW LB	Output	Speed	1/10 rpm
	2		LW HB			
	3		HW LB			
	4		HW HB			
2	5	uint32[1]	LW LB	Output	Scaled speed value	0/12500
	6		LW HB			
	7		HW LB			
	8		HW HB			
3	9	int32[2]	LW LB	Output	Acceleration	1/10 rpm/s
	10		LW HB			
	11		HW LB			
	12		HW HB			

Table 4-6: Profibus table *(continued)*

Parameter No.	Byte No.	Type	Byte / Bit position	Output / Input	Function	Measuring unit
4	13	uint32[1]	LW LB	Output	Maximum speed Reset via parameter 31	1/10 rpm
	14		LW HB			
	15		HW LB			
	16		HW HB			
5	17	int32[2]	LW LB	Output	Gap	1/10 V
	18		LW HB			
	19		HW LB			
	20		HW HB			
6	21	uint8[1]	Bit (0)	Output	Out 1 0 → "off" / 1 → "on" Reset by parameter 33	0/1
7	21		Bit (1)	Output	Out 2 0 → "off" / 1 → "on" Reset by parameter 33	0/1
8	21		Bit (2)	Output	Out 3 0 → "off" / 1 → "on" Reset by parameter 33	0/1
9	21		Bit (3)	Output	Out 4 0 → "off" / 1 → "on" Reset by parameter 33	0/1
10	21		Bit (4)	Output	Out 5 0 → "off" / 1 → "on" Reset by parameter 33	0/1
11	21		Bit (5)	Output	Out 6 0 → "off" / 1 → "on" Reset by parameter 33	0/1
12	21		Bit (6)	Output	Trip 0 → "Trip" 1 → "no Trip" Reset by parameter 33	0/1
13	21		Bit (7)	Output	Toggle 50ms	0/1
14	22	uint8[1]	Bit (0)	Output	Channel Ok (OK) - Latch 0 → "OK off (error - latch)" 1 → "OK on (no error)" Reset by parameter 30	0/1

Table 4-6: Profibus table *(continued)*

Parameter No.	Byte No.	Type	Byte / Bit position	Output / Input	Function	Measuring unit
15	22		Bit (1)	Output	Error rotational direction - Latch 0 → "no error" 1 → "error - latch" Reset by parameter 30	0/1
16	22		Bit (2)	Output	GapError Latch 0 → "no error" 1 → "error - latch" Reset by parameter 30	0/1
17	22		Bit (3)	Output	Sensor error Latch 0 → "no error" 1 → "error- latch" Reset by parameter 30	0/1
18	22		Bit (4)	Output	Not used	0/1
19	22		Bit (5)	Output	Not used	0/1
20	22		Bit (6)	Output	Not used	0/1
21	22		Bit (7)	Output	Total error byte 22 bit 0 3 0 → "no error" 1 → "error"	0/1
22	23	uint8[1]	Bit (0)	Output	Acknowledge bit for parameter 30	0/1
23	23		Bit (1)	Output	Acknowledge bit for parameter 31	0/1
24	23		Bit (2)	Output	Acknowledge bit for parameter 32	0/1
25	23		Bit (3)	Output	Acknowledge bit for parameter 33	0/1
26	23		Bit (4)	Output	Acknowledge bit for parameter 34	0/1
27	23		Bit (5)	Output	Acknowledge bit for parameter 35	0/1
28	23		Bit (6)	Output	Acknowledge bit for parameter 36	0/1
29	23		Bit (7)	Output	Acknowledge bit for parameter 37	0/1
30	1	uint8[1]	Bit (0)	Input	Reset latch of sum error[3]	0/1
31	1		Bit (1)	Input	Reset maximum speed[4]	0/1
32	1		Bit (2)	Input	Reset Rotational direction[5]	0/1
33	1		Bit (3)	Input	Reset Latch[6]	0/1

Table 4-6: Profibus table *(continued)*

Parameter No.	Byte No.	Type	Byte / Bit position	Output / Input	Function	Measuring unit
34	1		Bit (4)	Input	Test value 1[7]	0/1
35	1		Bit (5)	Input	Test value 2[7]	0/1
36	1		Bit (6)	Input	Not used	0/1
37	1		Bit (7)	Input	Not used	0/1

1 *uint: unsigned integer*
2 *int: signed integer*
3 *Reset of parameters 14 to 17*
4 *Reset of parameter 4*
5 *Reset of the internal rotational direction information, though not of the stored status.*
6 *Same function like digital input “Reset Latch” respectively command “Reset Latch” of the configuration software.*
7 *Same function like digital inputs “Test value 1” respectively “Test value 2”. Ensure that the digital input “Enable test value” is not active (connected to +24V) otherwise it is not possible to activate the test values through the Profibus communication.*

4.3 Mechanical prerequisites

The operation of the AMS 6300 SIS requires a trigger wheel with a definite mechanical design. Best possible measuring results can be achieved with a trigger wheel with rectangular tooth formation. However, other trigger wheels, for example, with involute gearing may also be used. The requirements are described below.

⚠ CAUTION

With safety function "Protection against wrong rotational direction" use exclusively trigger wheels with rectangular tooth formation, according to the requirements described in chapter Trigger wheel with rectangular tooth profile.

4.3.1 Eddy current measuring chain

Boundary conditions

The recommendations below are interpreted on the following boundary conditions:

- Eddy current measuring chains with sensors PR 6422, PR 6423 and PR 6424.
- Measuring chains are calibrated on the respective material of the trigger wheel, standard calibration material is 42 Cr Mo 4.
- No Ex-application (the influence of safety barriers is described in the operating manual of the signal converter).

Specify a trigger wheel or, if the trigger wheel is available, chose a sensor to achieve the best possible signal amplitude for the measurement. The maximum number of teeth for the trigger wheels is limited to 1000.

Trigger wheel with chamfered flanks (gear wheel)

Use trigger wheels with chamfered flanks (gear wheels) for the speed measurement or for the detection of rotational direction only if the safety function "Protection against wrong rotational direction" is not needed.

Such a trigger wheel for the use with eddy current measuring chains with sensors of type PR 6422, PR 6423, or PR 6424 should meet the following requirements:

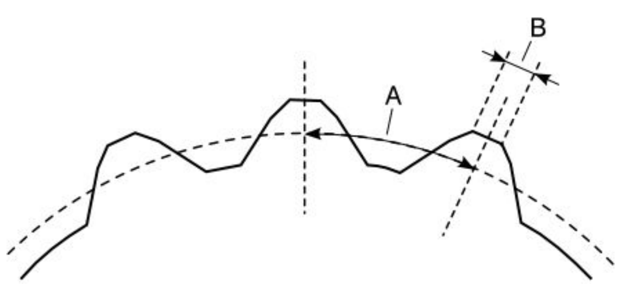
- The width of the wheel should meet the requirements as described in Width of trigger wheel
- Recommended width of the tooth-tip:
  - Type PR 6422: 4 mm
  - Type PR 6423: 6 mm
  - Type PR 6424: 12 mm
- When using trigger wheels with normal toothing, the following modules (gear parameter) are recommended:
  - Type PR 6422: module ≥ 8
  - Type PR 6423: module ≥ 12
  - Type PR 6424: module ≥ 24

Calculate the gear parameter (module) with the following formula:

Module = P/π

Pitch P is the distance between the tooth centers on the pitch circle (see Figure 4-23).

Figure 4-23: Distance tooth center to tooth center gear wheel

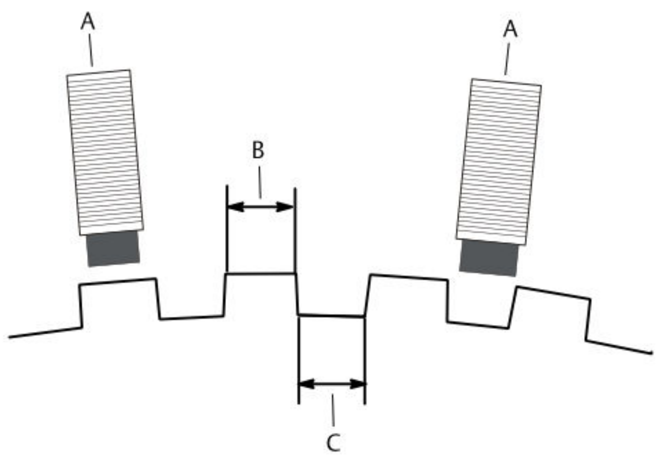


A. *Pitch P*
B. *Width of the tooth tip*

Trigger wheel with rectangular tooth profile

A trigger wheel with rectangular tooth profile is the ideal trigger wheel for the AMS 6300 SIS since beside others these wheels offer the maximum signal amplitude. See Figure 4-24 for this tooth profile.

Figure 4-24: Trigger wheel with rectangular tooth profile



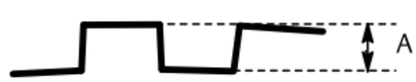
A. *Eddy current sensor PR 642x*
B. *Tooth tip*
C. *Tooth base*

The following sections describe the mechanical requirements for trigger wheels with rectangular tooth profiles.

Tooth depth

Chose the tooth depth of the trigger wheel so that the sensor does not detect the ground of the gap between the teeth. This results in higher signal amplitudes and consequently in a better signal-noise ratio (see also Adjustment and arrangement of sensors at the machine). For this reason, the tooth depth should be greater than the measuring range of the sensor. Suppose approximately twice the sensor measuring range as a standard value for the tooth depth. If, for example, a PR 6423 sensor at 2 mm measuring range is used, the tooth depth should be approximately 4 mm.

Figure 4-25: Tooth depth



A. *Tooth depth*

Width of trigger wheel

The width of the trigger wheel should be larger than D+2*X plus the expected axial displacement (see Figure 4-26). A smaller width of the trigger wheel may lead to the reduction of signal amplitudes or even to the total signal loss if the axial displacement moves the trigger wheel out of the measuring range of the sensor. Table 4-7 below shows distance X depending on the sensor type.

Example for the minimum width with a PR 6423 sensor and 2 mm axial displacement:

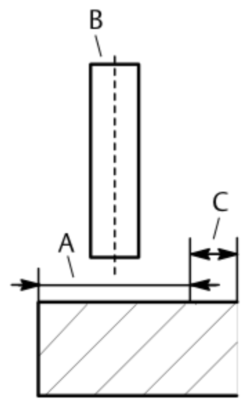
$Width\_of\_the\_wheel_{min} = D+2*X+Axial\_displacement$

$Width\_of\_the\_wheel_{min}$ = 8 mm+2*3 mm+2 mm=16 mm

Table 4-7: Trigger wheel width

Sensor type	Head diameter D [mm]	Distance X [mm]
PR 6422	5.2	5
PR 6423	8	3
PR 6424	16	3

Figure 4-26: Trigger wheel width



A. Axial displacement

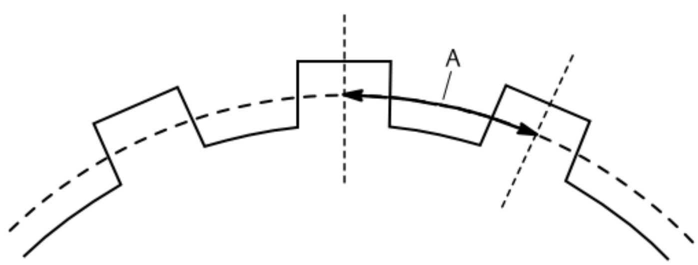
Module

The module (gear parameter) of a trigger wheel defines which type of sensor can be used for the measurement at this wheel. If the trigger wheel is not available yet, it can be manufactured according to the requirements of the sensor. Calculate the gear parameter (module) with the following formula:

Module = P/π

Pitch P is the distance between the tooth centers on the pitch circle (see Figure 4-27).

Figure 4-27: Distance tooth center to tooth center rectangular tooth profile



A. Pitch P

Below, the recommended gear parameters for trigger wheels with rectangular tooth profiles are shown for individual sensor types.

- PR 6422: module ≥ 4
- PR 6423: module ≥ 6
- PR 6424: module ≥ 10

Note
For the detection of the rotational direction in measuring mode "Trigger wheel" (AMS 6300 Configuration, parameter **Measuring mode (Pulse form)**) a trigger wheel with a symmetry of 50/50 is required.

4.3.2 Hall effect sensor

Recommended specification of the trigger wheel for the use of PR 9376.

Boundary conditions

The recommendations below are interpreted on the following boundary conditions:

- Hall effect sensor PR 9376
- Material for the trigger wheel is magnetically soft iron or steel (for example: ST 37).
- The maximum number of teeth for the trigger wheels is limited to 1000.

Module and tooth depth

Module

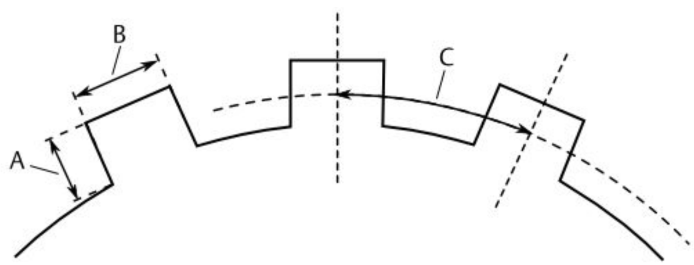
The recommended minimum module is 1.

Calculate the module with the following formula:

Module = P/π

Pitch P is the distance between the tooth centers on the pitch circle (see Figure 4-28).

Figure 4-28: Recommended trigger wheel shape



A. Tooth depth
B. Tooth tip width
C. Distance tooth center to tooth center (P)

Trigger wheels with rectangular tooth profile can also be used if the tooth tip width is greater than 1.5 mm.

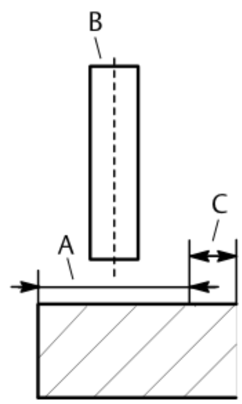
Tooth depth

The minimum tooth depth is 3 mm. See Figure 4-28

Trigger wheel width

Emerson recommends that the width of the trigger wheel should be larger than the diameter of the Hall effect sensor plus the expected axial displacement (see Figure 4-29). A smaller width of the trigger wheel may lead to the total signal loss if the axial displacement moves the trigger wheel out of the measuring range of the sensor.

Figure 4-29: Minimum width of trigger wheel



A. Tooth width depending on Hall effect sensor
B. Hall effect sensor
C. Axial displacement

4.3.3 VR sensor (variable reluctance sensor)

For trigger wheel requirements see associated sensor documentation.

4.4 Adjustment and arrangement of sensors at the machine

The correct speed measurement requires the correct adjustment and arrangement of the sensors at the machine.

4.4.1 Adjustment of eddy current measuring chains

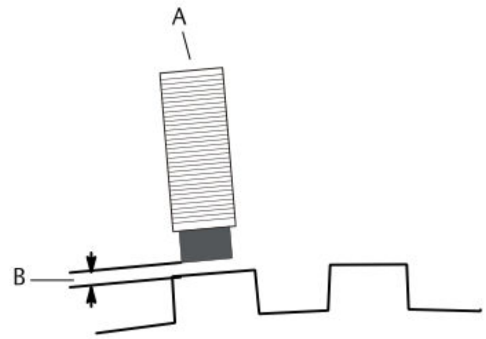
The distance between sensor and trigger wheel (see Figure 4-30) should be adjusted so that the output signal of the measuring chain provides a best possible signal amplitude. Consequently, mount the sensor as close as possible to the trigger wheel by observing the following minimum distance:

Distance = Initial gap sensor + radial clearance of the shaft

See calibration protocol of the used eddy current measuring chain for the initial gap value of the sensor. A typical value for the PR 6423 is about 0.55 mm and for the PR 6422 about 0.25 mm.

If the machine is equipped with plain bearings, also take the amount of the shaft lifting at the sensor mounting position into account.

Figure 4-30: Distance



A. *Eddy current sensor PR 642x*
B. *Distance*

Radial clearance (Radial vibration)

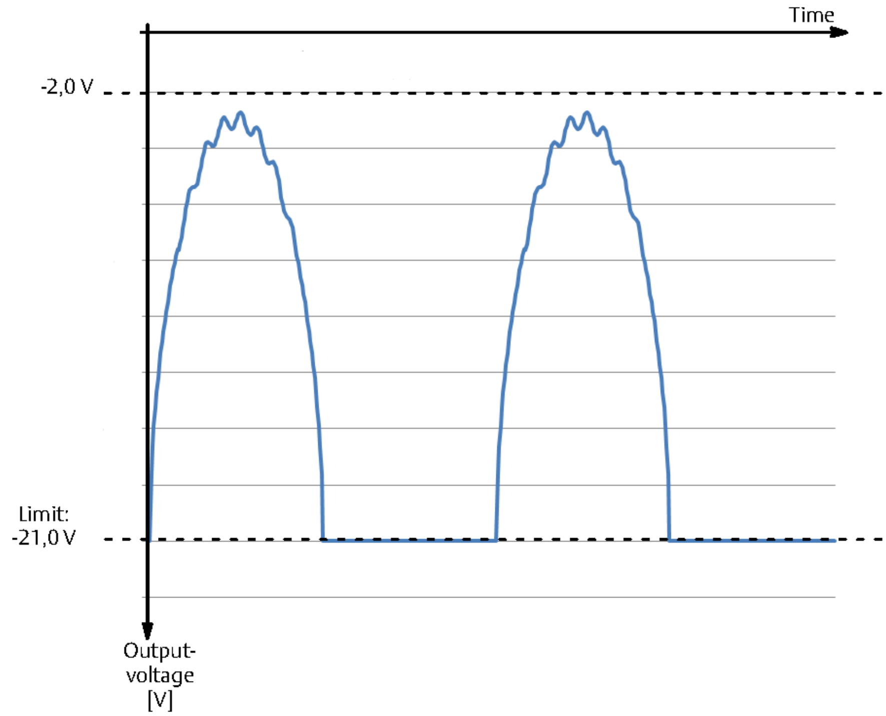
Radial vibrations of the machine make measurements of rotational speed more difficult or even impossible when the amount of the vibration exceeds a critical value. For this reason, the influence of the radial vibrations should be kept as low as possible. The guide value for the radial vibration of about 1/10 of the measuring range should not be exceeded.

Example:

A radial vibration amplitude of 200 µm and a measuring range of 2 mm for the PR 6423 leads to a disturbance signal of 1.6 V on the measuring signal (see Figure 4-31).

Note
In order to avoid negative influences of the radial vibration on the speed measurement, adjust the sensors so that a maximum signal amplitude is generated (signal limitation on -21.0 V DC).

Figure 4-31: Example signal with radial vibrations



Definition of the adjustment level

Define with the following formula the minimum voltage level for the sensor adjustment.

$U_{Adjust_{min}} = U_{Start} + (Distance^{*} (U_{End} - U_{Start}) / MB_{Sensor}$

$U_{Adjust_{min}}$:	Minimum required adjustment level
U_{Start}:	Start value of measuring chain voltage range
U_{End}:	End value of measuring chain voltage range
MB_{Sensor}:	Measuring range of the connected sensor
Distance:	Radial clearance + any other possibly available radial shaft displacements such as shaft lifting at plain bearings

Example (Figure 4-32) with an eddy current measuring chain consisting of a PR 6423 (2 mm measuring range) and a signal converter with an output voltage range -2 to -18 V. Radial clearance = 0.2 mm and shaft lifting = 0.2 mm.

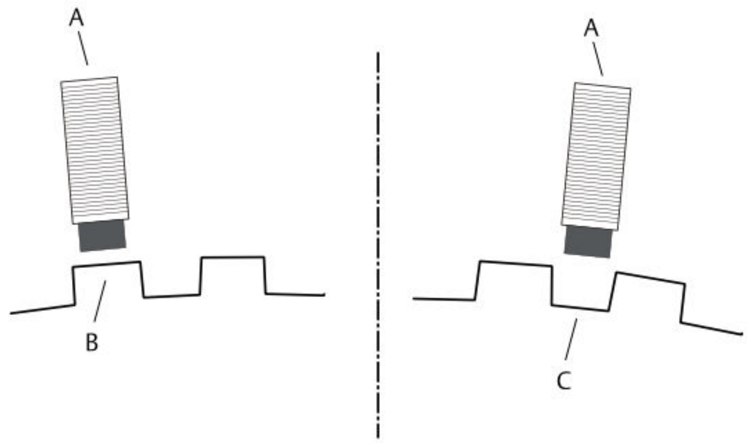
$U_{Adjust_{min}}$ = -2 V+(0.4mm * (-18 V-(-2 V)))/2 mm

$U_{Adjust_{min}}$ = -5.2 V

With an initial gap of 0.55 mm for the PR 6423 this corresponds to a distance of 0.95 mm between sensor and trigger wheel.

This adjustment and a maximum output level of the measuring chain of about -21.0 V results in a maximum signal amplitude of about 16 V.

Figure 4-32: Sensor adjustment example



Distance tooth tip - Sensor = 0.95 mm

A. *Eddy current sensor PR 6423*
B. *Sensor over tooth tip, U = -5.2 V*
C. *Sensor over tooth base, U = approximately -21 V*

Important for a proper speed measurement is also a rigid and vibration-free holder for the sensor. Vibrations between sensor and trigger wheel will induce additional voltage pulses and may produce measuring errors.

Note
Mount and secure the sensors so that a contact to the trigger wheel during operation is excluded. Disregard of this may lead to damages of the sensors and as a consequence to the breakdown of speed measurement and detection of the rotational direction.

When connecting sensors, bear in mind that the cables are not installed in parallel to high power cables or to cables of power converters to avoid disturbances.

Note
When installing intrinsically safe systems, the installation has to be carried out according to the standards for electrotechnical installations and the legal regulations of the manufacturing country only by an expert with experience and knowledge of explosion protection.
In Ex-applications the speed sensor may only be connected to intrinsically safe circuits (safety barrier).

For the adjustment of eddy current measuring chains at the machine, proceed as follows:

1. Connect the measuring chain to the AMS 6300 SIS. The measuring chain is directly supplied by the monitor (-24 V DC). If the AMS 6300 SIS system is not installed yet, supply the measuring chain with an external power supply (-24 V DC).
2. Connect a dc voltmeter to the signal output of the converter (pins GND /OUT).
3. Adjust the sensor, until the dc-output level corresponds to the calculated adjustment voltage $U_{Adjust_{min}}$.
   For this adjustment, the sensor has to face a tooth of the trigger wheel.

4. Tighten the sensor and all screws. When using signal converters CON 011, close the converter cover.
5. If it is not possible to perform the adjustment electrically with the sensor in front of a tooth of the trigger wheel, adjust the sensor mechanically with a mechanical distance gauge.

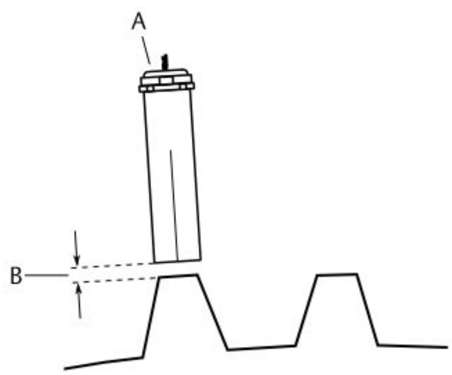
⚠ CAUTION

Take great care during the sensor adjustment to not damage the sensor while tightening the sensor screw with the distance gauge still in position.

4.4.2 Adjustment of Hall effect sensors

For speed measurements with Hall effect sensors of type PR 9376, adjust the sensor in a cold machine condition at a distance of 0.8 mm to 1.00 mm to the tooth with a distance gauge (see Figure 4-33). Ensure that the radial clearance of the trigger wheel does not exceed 0.2 mm

Figure 4-33: Hall effect sensor: distance



A. *PR 9376 Hall effect sensor with orientation mark.*
B. *Distance between sensor and tooth.*

Adjust the sensor so that the orientation mark is right-angled to the rotation direction of the trigger wheel.

At higher radial clearances of the trigger wheel or in case of great shaft unbalances set the sensor at a distance of approximately 1.5 mm. This requires a minimum trigger wheel module of 2 (see Hall effect sensor how to determine the module).

For general sensor installation information see PR 9376 specification sheet.

4.4.3 Adjustment of VR sensors

For sensor adjustment see associated sensor documentation.

4.4.4 Sensor arrangement at trigger wheels with rectangular tooth profile for safety function "Protection against wrong rotational direction"

The detection of rotational direction and function pulse comparison require a phase shift between the input signals of the channels. This phase shift is defined during the sensor installation with the design of the mounting brackets (mounting angle). With insufficient phase shifts the correct detection of the rotational direction is not possible. In this case, the pulse comparison detects a disturbance and switches off **Channel OK**. The optimum phase shift between the input signals is 120°. However, a minimum distance of 3° between all pulse edges have to be ensured (see safety manual AMS 6300 SIS).

Note
VR sensors can not be used for detection of rotational direction.

The mounting angles depend on the construction of the trigger wheel. Chose them based on the sensor position of channel A:

Sensor position channel B = Sensor position channel A + (n + 0,33) * P[1]

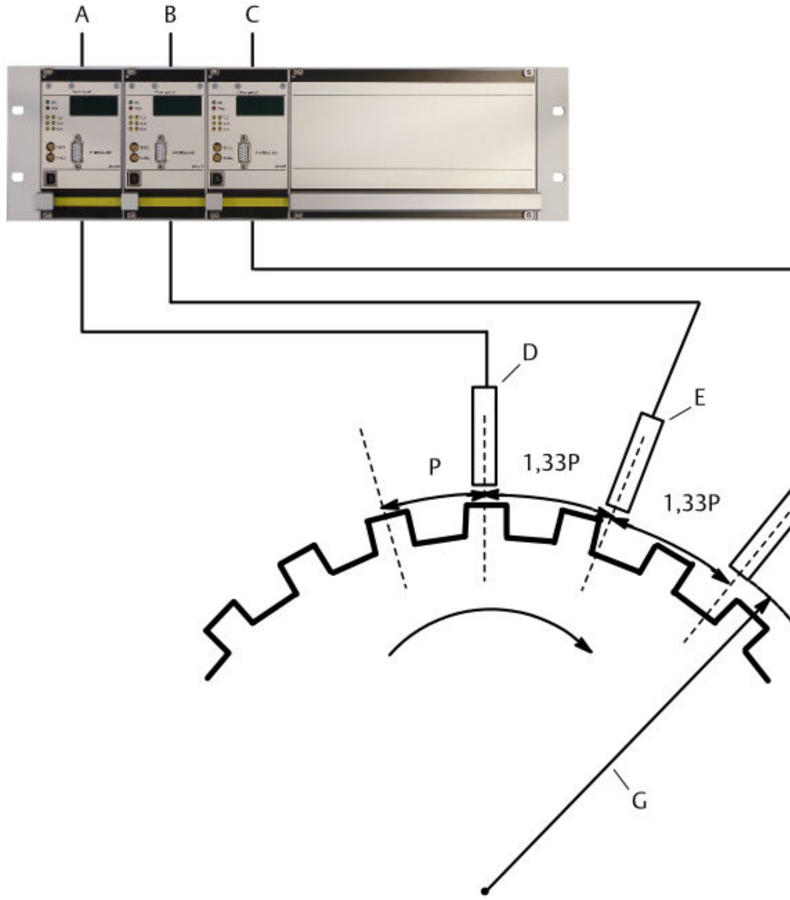
Sensor position channel C = Sensor position channel A + (n + 0,66) * P[1]

Figure 4-34 shows the arrangement of the sensors with the corresponding distances.

1 *P = distance between teeth*

P = (2πr)/n with n = 'number of teeth between the sensors' and 2πr = 'circumference of the trigger wheel plus distance to the sensor'

Figure 4-34: Arrangement of the sensors



A. *Channel A*
B. *Channel B*
C. *Channel C*
D. *Sensor A*
E. *Sensor B*
F. *Sensor C*
G. *r (radius trigger wheel + distance to the sensor)*

Possible mounting positions for sensor B would be, for example:

Position sensor A + 1,33 * P; 2,33 * P; 3,33 * P; 4,33 * P; ...

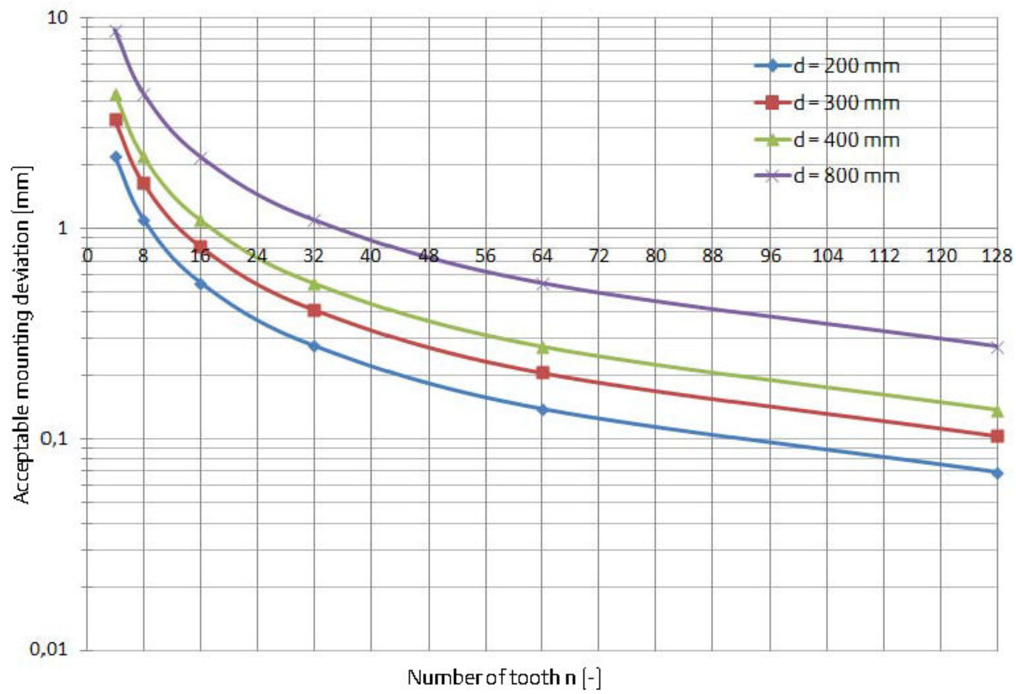
and for sensor C:

Position sensor A + 1,66* P; 2,66 * P; 3,66 * P; 4,66 * P; ...

Influence of mounting errors on the phase shift

For the correct operation of either function 'Detection of rotational direction' and 'Pulse comparison', the deviation of the phase shift must not exceed 5° of the calculated mounting position. Figure 4-35 shows the maximum permissible tolerance from the calculated mounting position depending on the number of teeth n and the diameter of the trigger wheel d [mm]. In general, at trigger wheels with a relatively great number of teeth the sensors have to be installed more accurately than at trigger wheels with a relatively small number of teeth.

Figure 4-35: Permissible tolerance from the mounting position



Depending on the diameter of the trigger wheel d [mm] and the number of teeth n[], calculate the maximum permissible deviation $\Delta_{Position}$ [mm] from the optimum mounting position with the following formula.

$\Delta_{Position} = (0.0139 * (d+2\ mm) * \pi)/n$

Example with a diameter of the trigger wheel d = 200 mm and a number of teeth n = 10

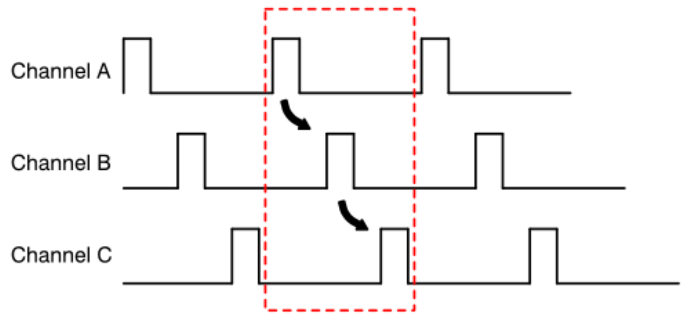
$\Delta_{Position} = (0.0139 * (200\ mm+2\ mm) * \pi)/10$

$\Delta_{Position} = 0.88\ mm$

4.4.5 Gear wheels

When using gear wheels as trigger wheels, an arrangement as described in Sensor arrangement at trigger wheels with rectangular tooth profile for safety function "Protection against wrong rotational direction" is not mandatory. However, take into account that the sensors are arranged so that there is a phase shift between the three sensor signals (see Figure 4-36).

Figure 4-36: Pulse sequence gear wheel



4.5 Minimum distance between sensors

To avoid mutual influences between sensors of type PR 642x, ensure not to install them below the minimum distance between the sensor heads. See installation guide of the converter used (CON 011: MHM-97858, CON 021/031: MHM-97859, or CON 041: MHM-97860) for further information.

4.6 Eddy current measuring chains in explosive areas

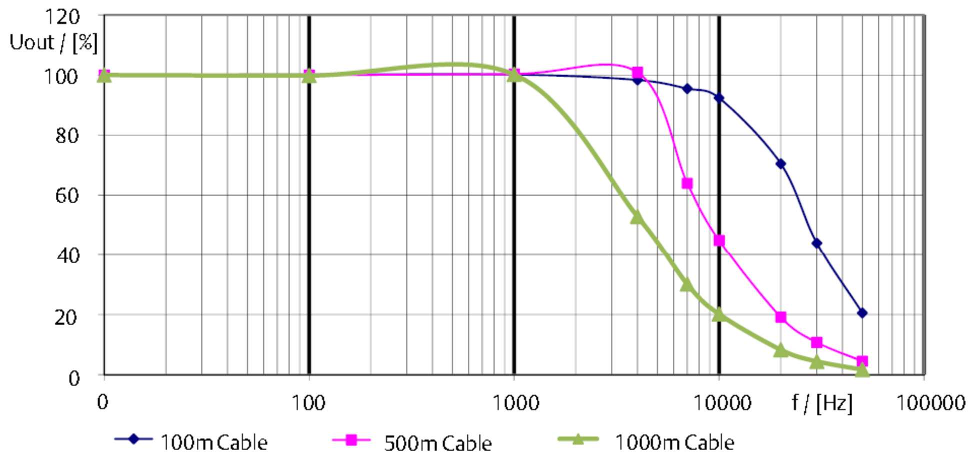
For instructions on the installation of eddy current measuring chains in explosive areas see installation guide of the respective signal converter (CON 011: MHM-97858, CON 021/031: MHM-97859, or CON 041: MHM-97860).

4.7 Influence of sensor cable on the signal

The electrical properties of the cables between sensors and AMS 6300 SIS monitor have an influence on the signal amplitude, especially at higher frequencies.

Figure 4-37 shows as example the influence of a cable of type LIYCY-CY 0.25 mm^2 with a conductor resistance of 75 mΩ/m and a capacity between the wires of 120 pF/m at cable lengths of 100 m, 500 m, and 1000 m on the amplitude of the sensor signal.

Figure 4-37: Influence of the cable on the sensor signal



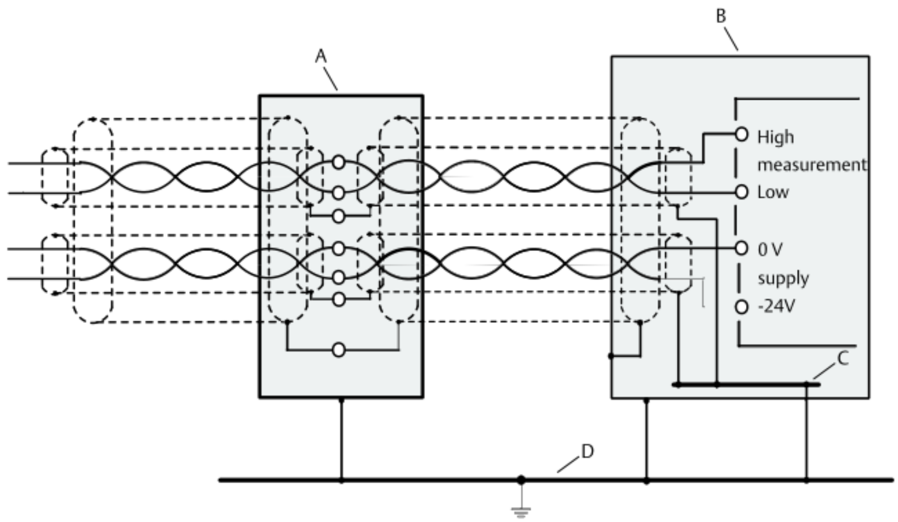
4.8 Shielding and grounding

The correct operation of AMS 6300 SIS monitors requires the correct connection of shields and ground wires of all devices in the system.

For connecting measuring chains and sensors, the use of double shielded cables with shielded twisted pairs and an additional outer shield is recommended. Emerson recommends using cables of type LIYCY-CY 2x2x0.25 mm^2. For longer distances (> approximately 400 m), chose cables with greater cross-sections.

Emerson recommends to make a defined connection between GND and measuring ground of the subsequent system (host computer or indicators). See Figure 4-38.

Figure 4-38: Shield connection of sensor cable



A. *Terminal box*
B. *Cabinet*
C. *Cabinet ground*
D. *Protection ground*

Shielding against electric fields

The shielding against electric fields requires the grounding of the cable shield on one side. Connect the outer and inner shield of the cable connected to the sensor input to the protective earth terminal directly at the cable inlet of the control cubicle.

Shielding against alternating magnetic fields

At disturbances by strong alternating magnetic fields it might be useful to connect the cable shield on either side to protective earth. To avoid disadvantages by possibly arising potential differences (hum- or ground loops), the cable shield can be put on reference potential through a capacitor and a resistor on one side.

4.9 Power-up and commissioning

4.9.1 Start with default configuration

When starting the AMS 6300 SIS the first time, the monitors are loaded with the default configuration. This is indicated with message **Default** in the monitor display after power is switched on. To make the system completely ready for use, modify the default configuration according to the requirements of the machine to be monitored. Configuration describes the configuration of the monitors. After the configuration is modified and loaded into the three monitors, the AMS 6300 SIS is ready for use.

Note
Possibly the trip outputs of the system are in the safe state (red **Trip** LED on the monitor front is switched on) after the configuration was loaded. Reset this trip message either

with an external signal through input **Reset Latch** (see Digital inputs) or with the a software command **Reset Latch** (see Monitor).

4.9.2 Start a configured system

The AMS 6300 SIS systems starts running as soon as the supply voltage is switched on. During the startup, the display of the respective AMS 6300 SIS monitor displays the device type and the firmware version for about 3 seconds. After this, the display shows an alternated indication of the measured speed and the text **Startup**. Having finished the start phase and if no system disturbances are detected, the display shows a continuous indication of the measured speed (see also Visualization).

During start-up, the trip output is set to the safe state. When the start phase was finished properly, the trip indication will be reset automatically. Prerequisite for this is that the outputs were not in the safe state before the card was switched on.

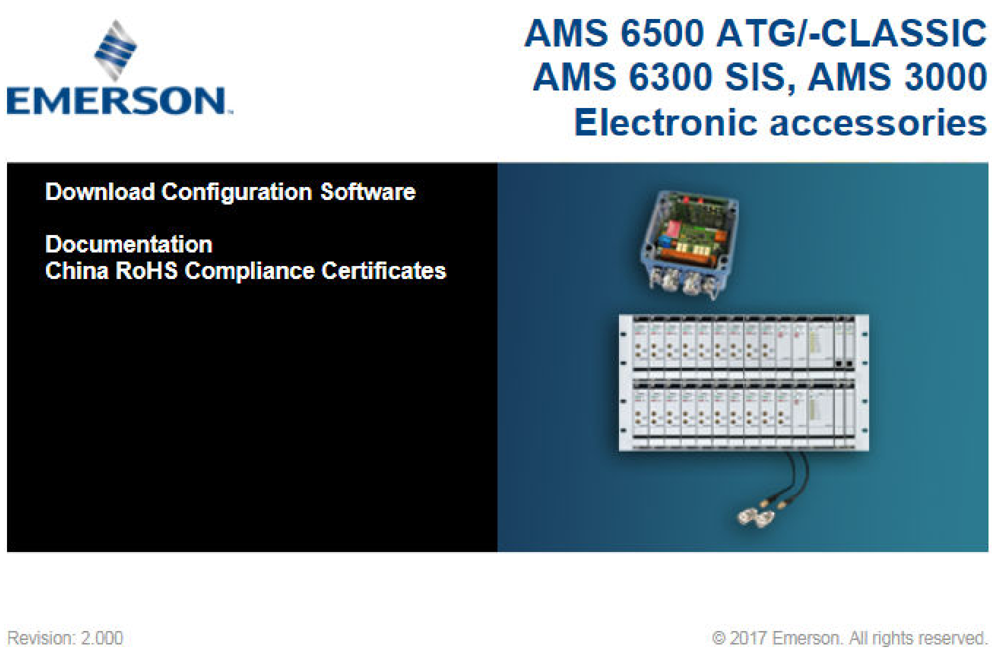
5 Configuration

The following chapter describes the configuration of the A6370 monitors with the AMS 6300 Configuration software. Download the software by using the link (see Figure 5-1) on the CD which is part of the configuration kit "A6910 Configuration Kit". Alternatively enter http://reliabilitymobile.com/apps/registration/Account/Login.aspx into the address bar of your internet browser. Beside this, the configuration kit contains an USB interface cable for the connection of a computer to the configuration interface of the monitor and measuring cables to check sensor signals and pulses.

Note

The software AMS 6300 Configuration can also be used to configure CSI 6300 SIS monitors.

Figure 5-1: CD index with link for downloading the configuration software



5.1 Configuration procedure

For the operation of the AMS 6300 SIS it is required to enter all operation parameters according to the requirements and to load them to the monitor.

Ensure that AMS 6300 Configuration is installed on the computer for the parameter input. The configuration can be performed offline that means without connection to the monitor or online with an interface connection to the monitor. Always load the configurationto the monitor. Each of the three monitors has to be configured separately. All safety relevant parameters except the trigger thresholds have to be set identically in the three monitors (A, B, and C). The following steps must be carried out:

5.1.1 Online configuration

Procedure

1. Connect the +24 V power supply to the AMS 6300 SIS and switch power on (see Power supply connection).
2. Connect the interface cable to computer and monitor (see USB configuration Interface).
3. Start AMS 6300 Configuration (see Start the configuration software).
4. Establish the communication between computer and monitor (see Connect the monitor).
5. Input of parameters (see Enter/edit parameters).
6. Determine and input of trigger thresholds (see Definition of the trigger thresholds).
7. Load the parameters to the monitor (see Sending configuration data to the monitor).
8. Repeat Step 2 to Step 7 for the other monitors.

After these steps the AMS 6300 SIS is ready for operation.

5.1.2 Offline configuration

Procedure

1. Start AMS 6300 Configuration (see Start the configuration software).
2. Input of parameters (see Enter/edit parameters).
3. If necessary, save the configuration (see File).
4. Connect the +24 V power supply to the AMS 6300 SIS and switch power on (see Power supply connection).
5. Connect the interface cable to computer and monitor (see USB configuration Interface).
6. Establish the communication between computer and monitor (see Connect the monitor).
7. If necessary, load the configuration (see File).
8. Determine and input of trigger thresholds (see Definition of the trigger thresholds).
9. Load the parameters into the monitor (see Sending configuration data to the monitor).
10. Repeat Step 5 to Step 9 for the other monitors.

After these steps the AMS 6300 SIS is ready for operation.

5.2 Installation of the configuration software

Install the AMS 6300 Configuration software on a computer with the following minimum requirements:

- Operating system: any variants of Microsoft Windows 7 and Microsoft Windows 10
- Standard Business/Office PC

- Minimum resolution of 1152 x 864 pixel

Start the installation of the software with a double-click on **Setup.exe** and follow the instructions on screen.

Note
For the installation of the software administrator rights are required.

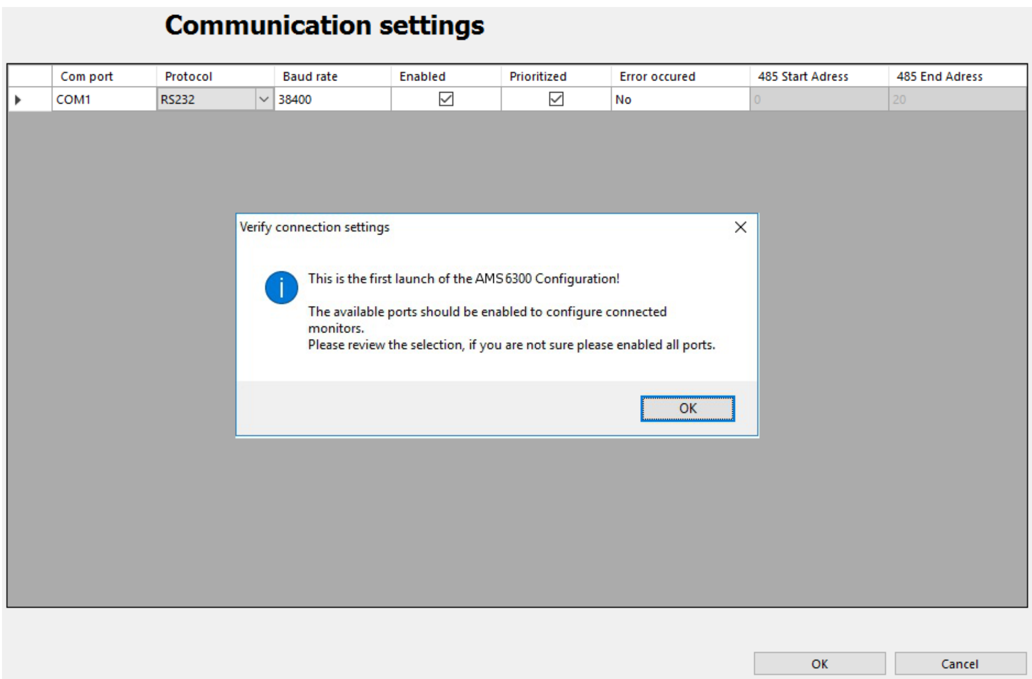
5.2.1 Start the configuration software

After the installation of the software click the program icon on the desktop (see Figure 5-2) or click **Start** → **Programs** → **Emerson Process Management** → **AMS 6300** → **AMS 6300 Configuration**.

Figure 5-2: Program icon

At the first start of the software the screen window with the list of detected com ports and the hint to check the indicated interfaces are opened (Figure 5-3). The communication settings are described in Settings.

Figure 5-3: First start of configuration software

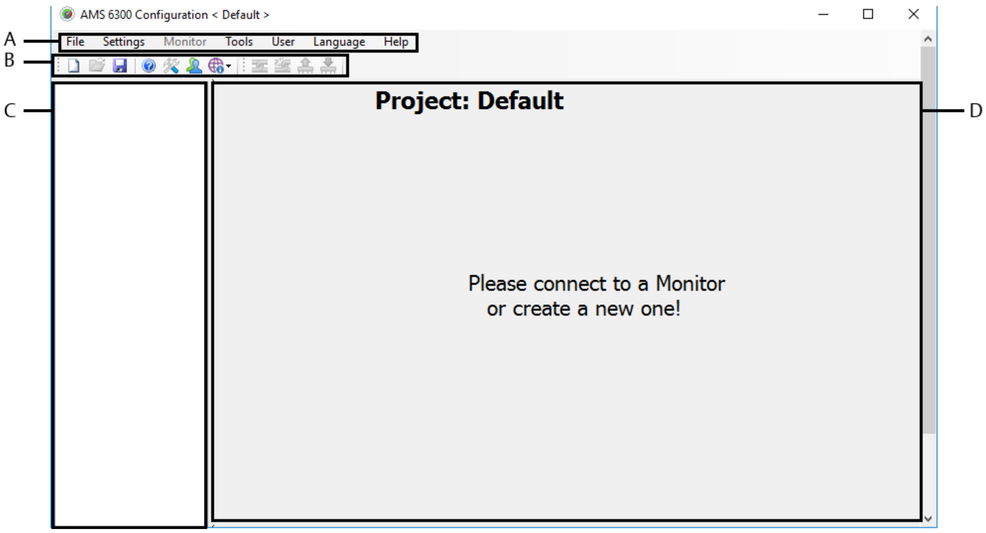


5.3 General description of user interface

5.3.1 Start menu

If there is no communication with a monitor, the software will start with the user interface as shown in Figure 5-4.

Figure 5-4: Start view



A. *Menu bar*
   The individual menus with their submenus are described below. The monitor-based menu ***Monitor*** *is gray-shaded in this view. It is only active when a monitor is selected in the project tree (see Monitor).*
B. *Symbol bar*
   The symbol bar contains buttons for frequently used commands and functions of the software and is described in more detail in Symbol bar.
C. *Project tree*
   All monitors of this project are listed in this tree. Project tree describes this tree structure.
D. *Indication / Desktop (project view, monitor-status view, or monitor-configuration view)*

File

This menu contains all commands to create, save, and open configuration files. Some of the menu items depend on the project tree, whether a monitor or a project has been chosen.

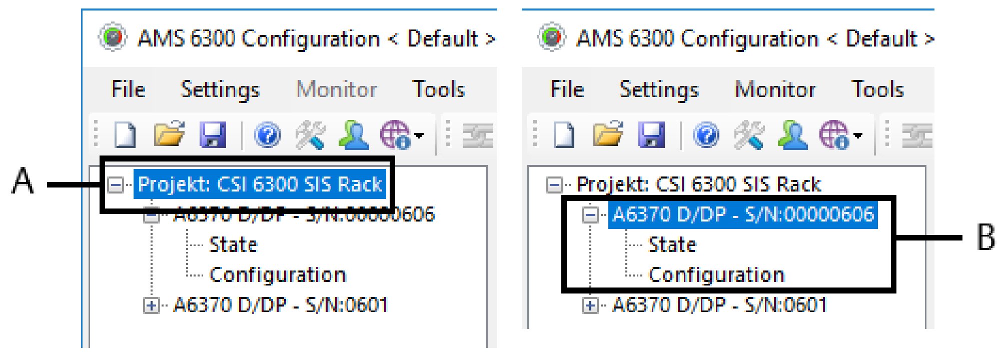
New

Click **New** → **Monitor** to add another monitor to the project. The new monitor appears in the project view as A6370 D monitor and in the project tree as “A6370 D - S/N:0000000x” and can then be configured. There are no differences in configuration between A6370 D and A6370 D/DP monitors. Click the monitor in the project view to open the monitor status view. The configuration dialog can be called up from this view.

Open

Click **Open** → **Project** to open the project files with the help of a file browser. Click a monitor in the project tree, (see Figure 5-5) to enable menu item **Configuration**. Use **Configuration** to load individual configuration files for the selected monitor.

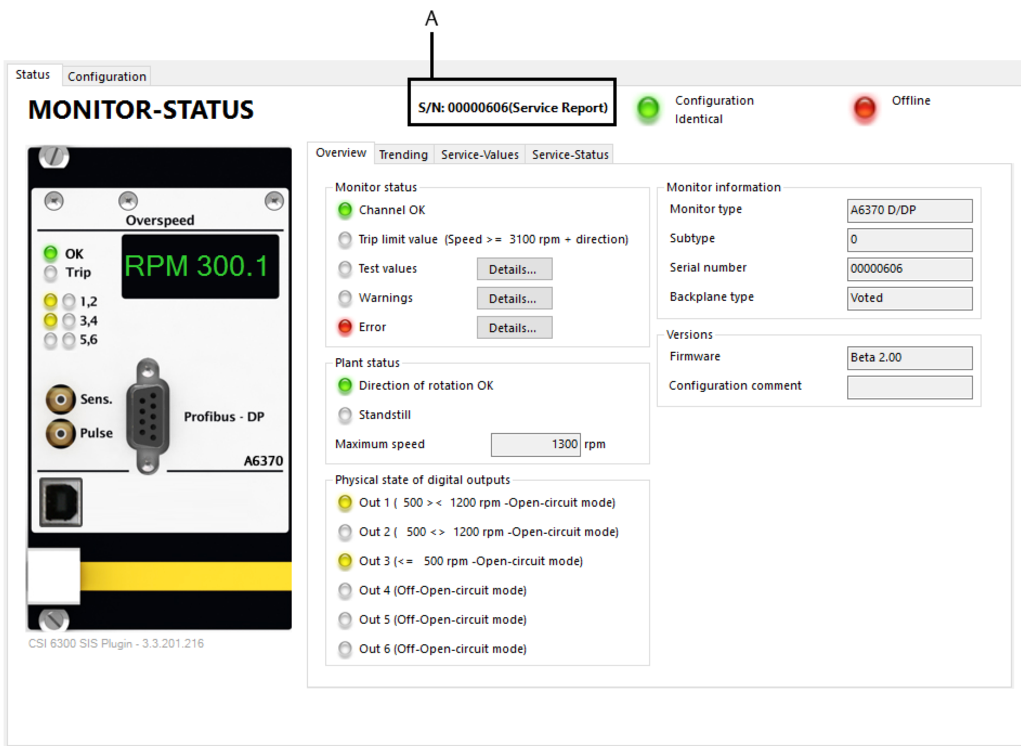
Figure 5-5: Project tree



A. Project selected
B. Monitor selected

Click **Service Report** to load a service report. A file browser opens. Select a Service Report from an arbitrarily storing locations. With confirmation of the selection a monitor with the extension **Service Report** will be added to the project tree. The service data is loaded into the status view and the configuration of the monitor. The data is marked in the status view with the indication **Service report** (see Figure 5-6).

Figure 5-6: Service report indication



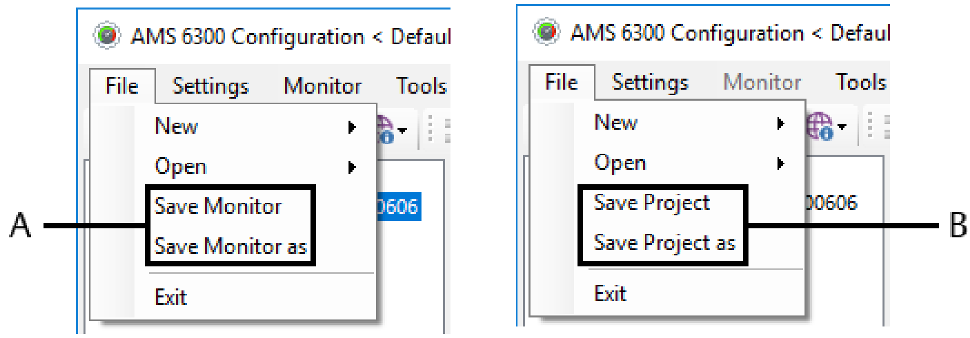
A. *Service report indication*

Save ... and Save as...

Click **Save** to save the data at the same location, without a further question dialog. If the data is not saved yet, the file browser opens to define file name and the storage location. Click **Save as...** to open the file browser. Depending on the situation whether a project or a monitor has previously been selected, the menu item for saving the data is adapted accordingly (see Figure 5-7).

- If a project was chosen, the menu items for saving the data are **Save Project** and **Save Project as**. The program saves the entire project structure including the configuration of all monitors of this project. To ensure that the latest available configuration data is saved, read the configuration data from the monitors before one of the save commands is clicked. File extension of the project file is **<*.pcfg>** and may be stored in any subdirectory.
- If a monitor was chosen, the menu items for saving the data are **Save Monitor** and **Save Monitor as**. The configuration of the selected monitor is saved. To ensure that the latest available configuration data is saved, read the configuration data before one of the save commands is clicked. File extension of monitor files is **<*.mcfg>** and may be stored in any subdirectory.

Figure 5-7: Menu item Save...



A. Save single monitor configuration
B. Save project

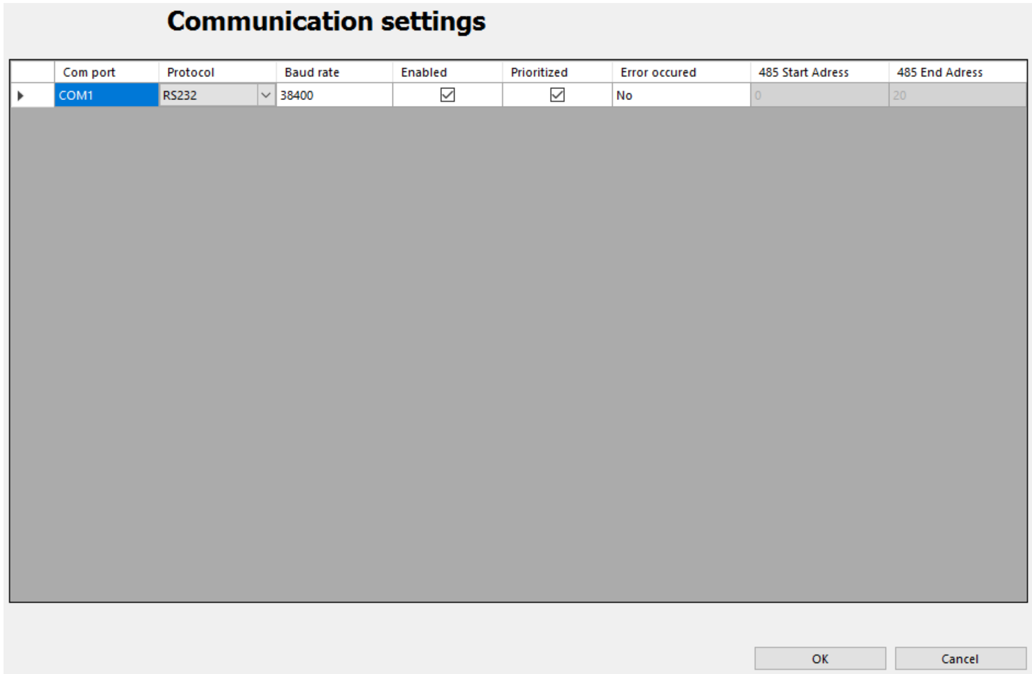
Close

Click **Close** to exit the configuration software. Any unsaved changes are lost.

Settings

This menu contains the single menu item **Communication**. Click **Communication** to open **Communication settings** (see Figure 5-8) for the configuration of the serial communication interfaces. This window shows all serial communication interfaces of the computer. Generally, the configuration software continuously scans all detected COM ports for connected monitors. Each interface can be configured individually. The possible settings are described below.

Figure 5-8: Serial communication interface settings



Note

The USB interface is not listed here as configuration of the USB connection is not necessary.

Protocol

Chose the communication protocol from the list field.

- RS 232
  Communication with the monitor through the configuration interface. This communication runs at a speed of 38400 baud.
- RS 485
  Communication through the serial RS 485 bus. Chose between different communication speeds.

Baud rate

Chose the communication speeds (baud rate) from these list fields.

- 38400 baud
- 57600 baud
- 115200 baud

Enabled

Place a checkmark in the box to activate the corresponding COM port – otherwise the COM port is disabled. Deactivate COM ports are not used for the communication with the protection system. This check box does only influence the configuration software, the system settings of the computer remain unaffected.

Prioritized

Generally, the configuration software continuously scans all detected COM ports for connected monitors. COM ports with a checkmark in the corresponding box are scanned at a higher priority.

Error occurred

This field shows, whether an error has occurred at this port.

485 Start Address / 485 End Address

Enter here an address range. This range is scanned by the software for connected monitors for the RS 485 bus communication. This has the advantage that not the entire address range must be scanned. To detect all connected monitors, the device addresses of all monitors should be known. The maximum address range is 0 to 255.

Click **OK** to accept the modifications and to close the window. Click **Cancel** to close the window without accepting the changes.

Tools

Configuration differences

Click **Configuration differences** to open the window for comparison of two or three configurations. Stored configuration files or configurations from connected monitors may be used.

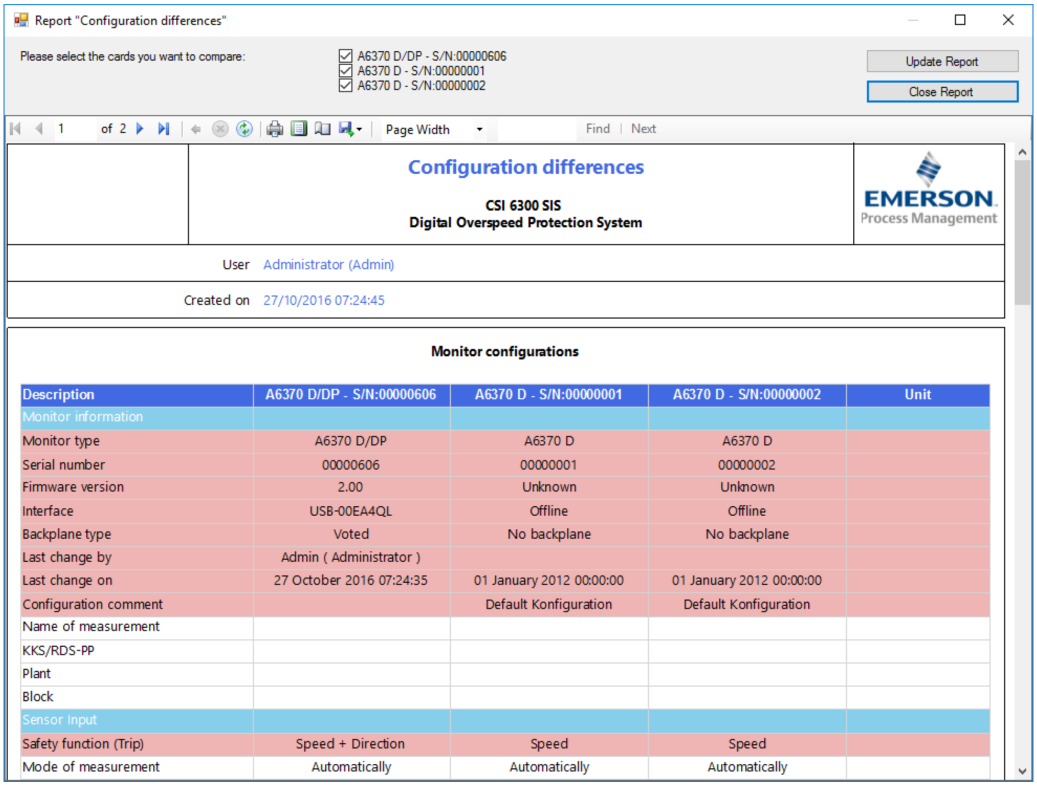
Figure 5-9 shows the window of the comparison functionality. All monitors of the current project are displayed in the upper section. A checkbox is assigned to each monitor. Place a checkmark in the respective box to select two or three monitors at max for the configuration comparison. Click **Update Report** to start the comparison of the selected monitors.

Rows with differences within the configurations are colored red. The individual parameters are grouped according to the configuration tabs. The tab names are colored blue.

Use the printing functionality if the result of the comparison shall be printed, for example, for archiving purposes.

Click **Close Report** to close the window of the comparison function.

Figure 5-9: Configuration differences



Description	A6370 D/DP - S/N:00000606	A6370 D - S/N:00000001	A6370 D - S/N:00000002	Unit
Monitor information				
Monitor type	A6370 D/DP	A6370 D	A6370 D	
Serial number	00000606	00000001	00000002	
Firmware version	2.00	Unknown	Unknown	
Interface	USB-00EA4QL	Offline	Offline	
Backplane type	Voted	No backplane	No backplane	
Last change by	Admin (Administrator)			
Last change on	27 October 2016 07:24:35	01 January 2012 00:00:00	01 January 2012 00:00:00	
Configuration comment		Default Konfiguration	Default Konfiguration	
Name of measurement				
KKS/RDS-PP				
Plant				
Block				
Sensor Input				
Safety function (Trip)	Speed + Direction	Speed	Speed	
Mode of measurement	Automatically	Automatically	Automatically	

The following example describes the comparison of a stored configuration file with a configuration of a connected monitor.

Procedure

1. Start the configuration software and connect the computer to an active (powered on) monitor. The software detects the monitor, adds it to the project, and loads the configuration to the computer.
2. Create a new monitor within the project (**File** → **New** → **Monitor**).
3. Click the new monitor to select it (description becomes blue-colored).
4. For the selected monitor, open the configuration file that shall be compared with the connected monitor (**File** → **Open** → **Configuration**).
5. Start the comparison (**Tools** → **Configuration differences**).
   The window of the comparison function opens and shows the result that can be printed.
6. Click **Close Report** to exit the comparison function.

User

This menu contains all commands necessary for Login, Log-off, and for the user administration.

Login

Click **Login** to open the **User log in** window. Enter here user name and password. At the first start of the software these are:

User name: Admin

Password: 3637766

After login with this standard access data, the monitors can be configured and new users registered with individual access rights. Without registration only the status indication of the monitors can be opened (user **View**).

Note
The password entry is case sensitive.
Emerson recommends to change the password for user "Admin" after the first login.

Logout

Click **Logout** to log-off the current user.

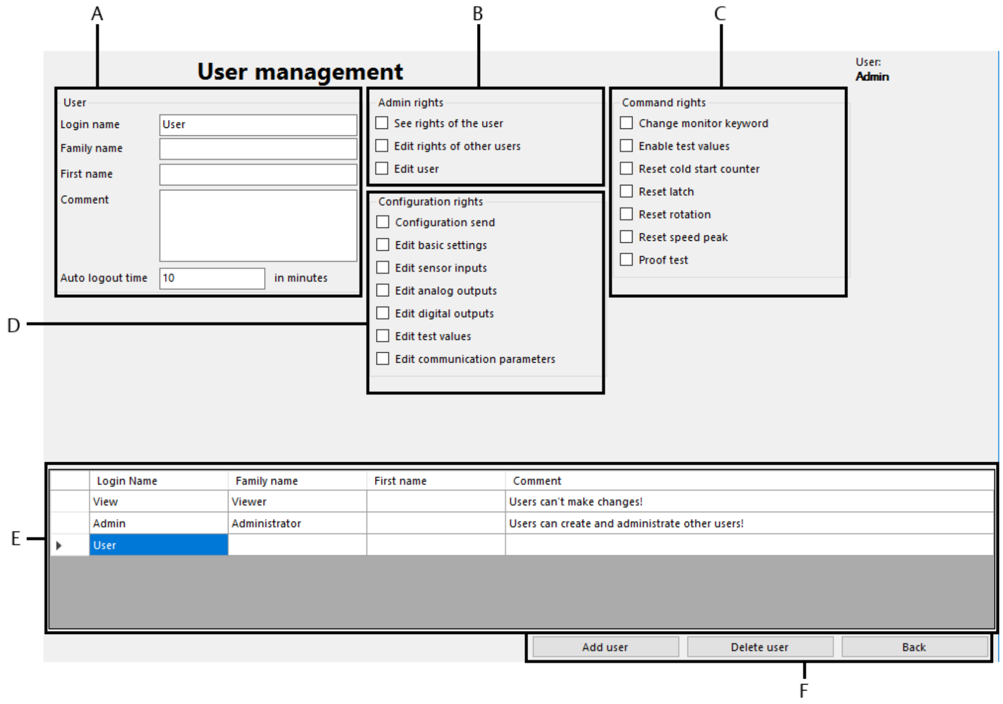
Administration

Click **Administration** to open the user management.

User management

Register, administer or remove users in this dialog. To make changes of these parameters, log-in as "Administrator" or as user with administrator rights.

Figure 5-10: User management



A. Entry fields for user data
B. Admin rights selection
C. Command rights selection
D. Configuration rights selection
E. List of registered users
F. Buttons

User

Enter the data of the user into this field. **Login name** is filled in automatically with the registration of a new user. Optionally fill in **First name**, **Last name**, and **Comment**.

Auto Logout time defines a time in minutes when the user is logged-off automatically. If "0" was entered here, there is no auto log-off. The maximum log-out time is 1440 minutes.

Admin rights

Place a checkmark in the corresponding box to assign the required administrator rights to the user:

- **See the rights of the user**
  The user can read access rights of other users.
- **Edit right of other users**
  The user can edit access rights of other users.
- **Edit users**
  The user can register new users.

Note
Modifications of the data of user **Admin** or removing this user is not possible. It is only possible to change the administrator password.

Configuration rights

Place a checkmark in the corresponding box to assign one or more of the following authorizations for the configuration of monitors to the users.

- **Configuration send**
  The user has the authorization to load parameters to a monitor.
- **Edit basic settings**
  The user has the authorization to edit all parameters of tab **Initial setup**.
- **Edit sensor inputs**
  The user has the authorization to edit all parameters of tab **Sensor input**.
- **Edit analog outputs**
  The user has the authorization to edit all parameters of tab **Analog output**.
- **Edit digital outputs**
  The user has the authorization to edit all parameters of tab **Digital output**.
- **Edit test values**
  The user has the authorization to edit all parameters of tab **Test values**.
- **Edit communication parameters**
  The user may change baud rate and bus address of the monitor.

Command rights

Place a checkmark in the corresponding box to assign one or more of the following authorizations regarding the carrying out of commands to the user.

- **Change monitor keyword**
  The user has the authorization to change the keyword stored in the monitor.
- **Enable test values**
  The user is authorized to activate the configured test values.
- **Reset cold start counter**
  The user is authorized to reset the internal cold start counter.
- **Reset latch**
  The user may reset latched alarm outputs.
- **Reset rotation**
  The user may reset the indicated rotational direction.
- **Reset speed peak**
  The user may reset the stored speed peak value.
- **Proof test**
  The user is authorized to carry out the proof test.

List of registered users

This list shows all available user accounts. Click the corresponding line to chose an user account and edit it. Editing requires the admin rights **Edit right of other users** and **Edit users.**

Buttons

Add user

Click **Add user** to create a new user, provided the user has the corresponding authorization for this.

Delete user

Click **Delete user** to delete the selected (blue shaded) user name from the list after a confirmation enquiry was acknowledged. The administration account cannot be deleted.

Back

Click **Back** to close the user management. All changes are stored automatically.

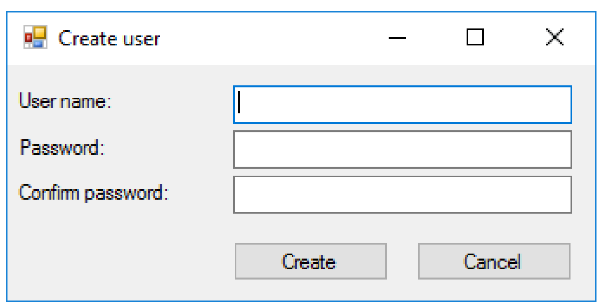
Create a new user

To create a new user, log-in as **Admin** or as user with administrator authorization. The currently logged in user is shown in the top right corner of the use management window. To create a new user:

Procedure

1. Click **Add user** to open the input window **Create user** (see Figure 5-11) .

Figure 5-11: Create new user



2. Enter **User name** and **Password**. The **Password** must consist of at least six characters. The maximum number of characters for the password is 20. The following characters are permitted for the input of the password:
   - a to z
   - A to Z
   - 0 to 9
   - ! " # $ % & ' ( ) * + , . / : ; < = > ? @ [\ ] ^ _ ` { | } ~
3. Click **Create** to accept the data of this new user.
   The user is added to the list of user accounts.
4. Assign required access rights to the new user.

Change Password

Click **Change Password** to change the password of the currently logged in user. The password has to consist of at least 6 and not more than 20 characters.

Language

Click Language to open the selection list. Select the desired language.

Help

About...

Click **About...** to open the window containing program information and the version of the configuration software.

Help

Click **Help** to open the help file.

Symbol bar

The following commands can also be activated by buttons on the symbol bar:

 New (see File)

 Open (see File)

 Save (see File)

 Help (see Help)

 Communication settings (see Settings)

 User management (see User management)

 Language selection (see Language)

 Establish connection (see Monitor)

 Disconnect connection (see Monitor)

 Receive configuration (see Receiving the configuration from the monitor)

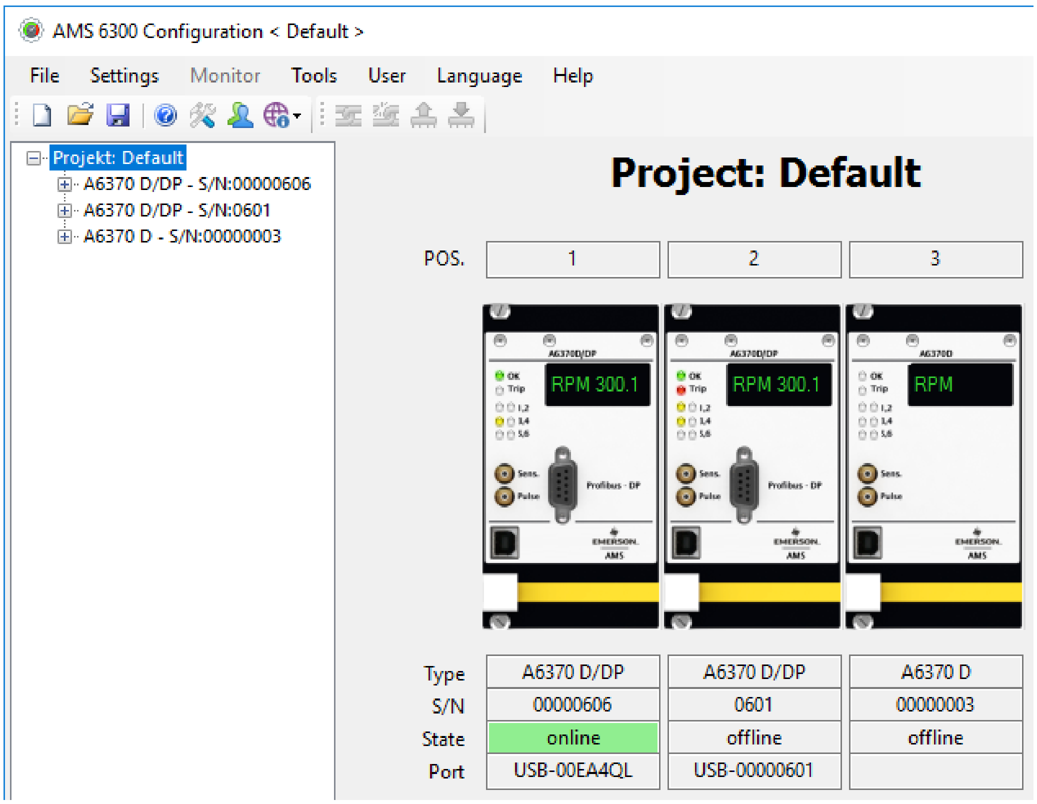
 Send configuration (see Sending configuration data to the monitor)

Project tree

Figure 5-12 shows an example project with three AMS 6300 SIS monitors. The monitors are listed below the project name. Monitors are added to the project tree either with command **File** → **New** or by connecting a monitor through an interface (USB, COM Port, or RS 485). The monitor name consists of the product name and the serial number or the name of the measurement (see Group Label). To edit the configuration of a monitor, select the corresponding monitor from the project tree or from the graphical presentation of the monitors. The monitor status view opens.

The name of the project tree can be changed. Right click on the project name to rename the project. The project name can also be changed when saving the project (**Save as...**).

Figure 5-12: Project tree example



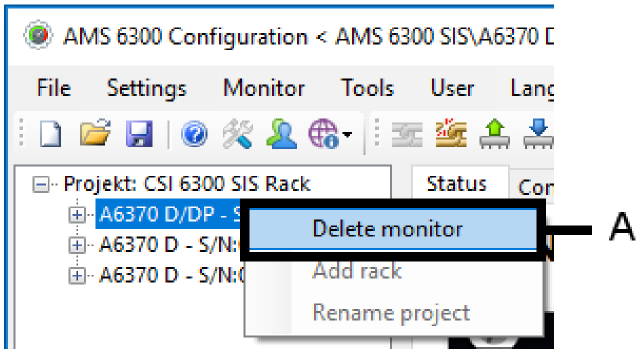
Delete a monitor from the project tree

Follow the steps to delete a monitor from the project tree.

Procedure

1. Right click on the monitor to open the pop-up menu with command **Delete monitor** (see Figure 5-13).

Figure 5-13: Delete monitor



A. *Pop-up menu with command: delete monitor*

2. Click **Delete monitor** to delete the selected monitor from the project tree. All previous changes of its configuration are lost.

5.3.2 Monitor - graphical user interface

For a monitor selected in the rack overview, the user interface offers two main interfaces, the monitor status interface **Status** and the monitor configuration interface **Configuration**. Menu item **Monitor** is enabled on the menu bar. This menu item contains the monitor commands described below.

Monitor

All commands in this menu require an online connection to the monitor and a corresponding user authorization.

Connect and Disconnect

Select **Disconnect** to close the existing connection between configuration interface (COM port or USB) of the computer and the monitor. Click **Connect** to re-establish the connection to the monitor.

Identify

Select **Identify** to start a short sequence to identify the connected monitor in the rack. First, this command switches all LEDs of the monitor front on and then it effects a short alternated flashing of the LEDs 1, 2, 3, and 4 and the monitor display shows the message **Identify**. This function does not affect the measuring operation of the monitor.

Note
Use this command to check if all LEDs of the monitor front are functional.

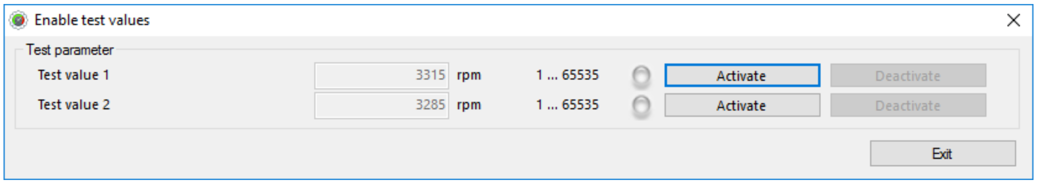
Automatic trigger threshold adjustment

Click **Automatic trigger threshold adjustment** to open the dialog for the automatic setting of the trigger thresholds. See Automatic trigger threshold detection for description of detection and setting of trigger thresholds.

Enable test values

Select **Enable test values** to open the **Enable test values** dialog for activating or deactivating of both configured test values (Figure 5-14). See Test values for further information on the use of test values.

Figure 5-14: Dialog Enable test values



Proof test

Select **Proof test** to open the **Proof test** dialog. Within the context of SIL compliant installations, the execution of a proof test may be an important requirement. For further information see safety manual "SFM 6100 9020 safety manual AMS 6300 SIS". Proof test describes this test.

Reset start counter

Select **Reset start counter** to set the counters **Reboots** and **Cold starts** to zero.

Reset latch

Select **Reset latch** to reset all latched alarms and the Trip output, provided the measuring value is in the good range again (below limit value including hysteresis).

Reset rotation

Select **Reset rotation** to reset the current information of the rotational direction according to the configured **Preferred rotational direction** (see Group Measuring functions). The command has an effect on the function outputs (digital outputs) configured for the output of function **Direction of rotation** and for any further messages regarding the rotational direction.

Reset speed peak

Select **Reset speed peak** to set the detected maximum speed, stored in this monitor, to zero.

Set monitor keyword

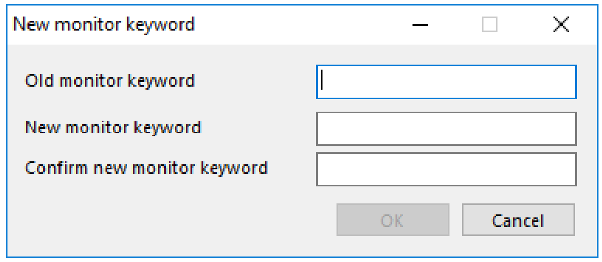
Select **Set monitor keyword** to open the **New monitor Keyword** dialog (see Figure 5-15). The keyword is stored in the monitor and checked when sending the configuration. Operation of a monitor without keyword protection is not possible.

The keyword must consist of at least 6 and not more than 20 characters. The following characters are permitted:

- a to z
- A to Z
- 0 to 9

- ! " # $ % & ' ( ) * + , . / : ; < = > ? @ [\ ] ^ _ ` { | } ~

Figure 5-15: Dialog New monitor Keyword



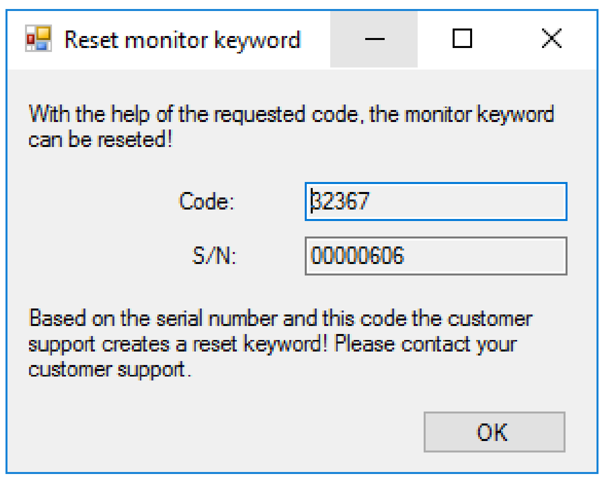
Note

After the first input of the monitor keyword within one session (time period with a user has logged in) the keyword remains stored until the user is logged off again. Within the session it is not necessary to enter the keyword again.

Reset monitor keyword

Select **Reset monitor keyword** to open the **Reset monitor keyword** dialog (see Reset monitor keyword). This dialog shows a code and the serial number of the connected monitor. The steps below describe how to reset the keyword.

Figure 5-16: Dialog Reset monitor keyword



1. Contact your local service center (see Technical support).
2. Name the indicated code and the serial number. Click **OK** to close the dialog.

   Note

   Do not open the **Reset monitor keyword** dialog again, until the input of the received keyword for the reset. At any time this dialog is opened, a new code for the monitor is generated. Based on this code, the keyword for the reset is generated. With a new code, a previously generated keyword becomes invalid.

   You will be given a keyword to reset the monitor keyword. This reset keyword is only valid once.

3. Click **Monitor** → **Set monitor keyword** to open the **New monitor Keyword** dialog.
4. Enter the received keyword for the reset in field **Old monitor keyword** and define a new keyword for the monitor (fields **New monitor keyword** and **Confirm new monitor keyword**).
   The new keyword must consists of at least 6 and not more than 20 characters.
5. Click **OK** to confirm the change and to close the dialog.

Set communication parameter (only RS 485 and PROFIBUS communication)

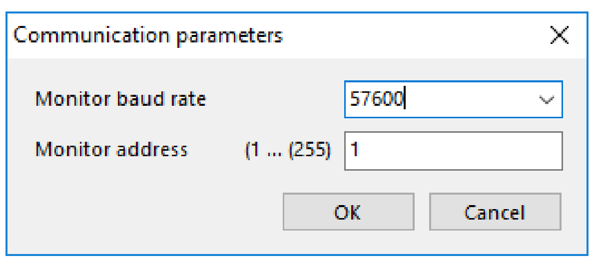
Select **Set communication parameter** to open the **Communication parameters** dialog (see Figure 5-17). Define here baud rate and address for the communication through the RS 485 interface. The monitor address applies also for the PROFIBUS communication.

Note
To enable the address change for the PROFIBUS communication, power the respective monitor off and on again. This can be done, for example, by pulling out and plugging in the monitor. It is not necessary to restart the monitor if the address is only used for communication through the RS 485 interface.

Parameter **Monitor baud rate**:	Select between 38400, 57600, and 115200 baud. The baud rate must be identical at all devices connected to one bus line.
Parameter **Monitor address**:	Set an address in the range of 1 to 255. Each device connected to the same bus must have a unique address. Two devices on the same bus with the same address will lead to communication problems.

The settings that appear after the opening of the dialog are currently stored in the monitor. Click **OK** to store the changes of the parameters in the monitor.

Figure 5-17: Dialog Communication parameters



Configuration

This menu contains configuration related commands.

Receive

Click **Receive** to read the configuration parameters from the connected monitor.

Send

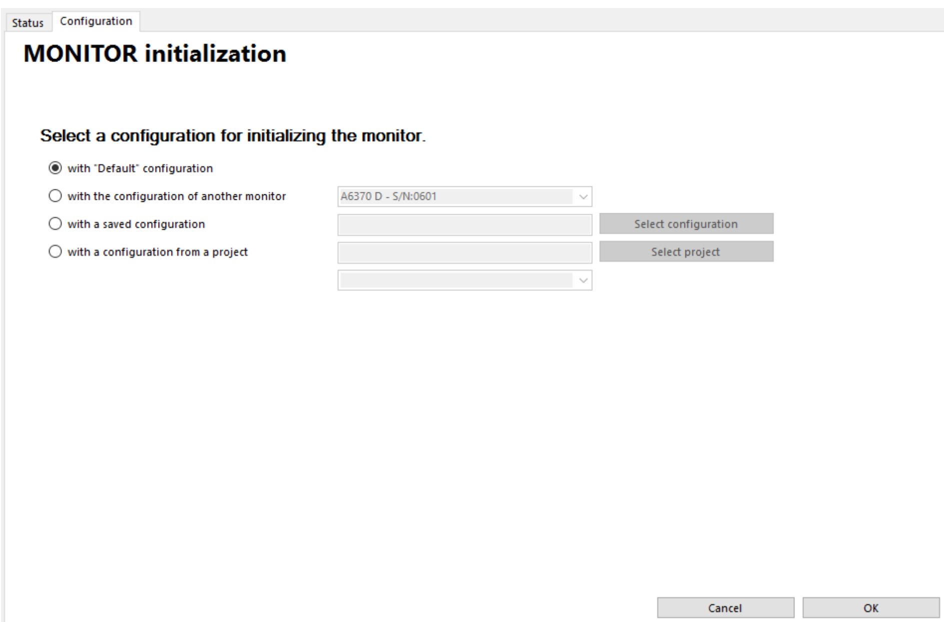
Click **Send** to load configuration parameters to the monitor. Before the loading process starts, a dialog opens to confirm the safety relevant parameters.

Initialize

Click **Initialize** to open the assistant for the monitor configuration (see Figure 5-18). To avoid creating a configuration completely new, a standard configuration can be loaded. Adapt this standard configuration to the mechanical requirements and further specifications for the measurements such as number of teeth and trigger thresholds.

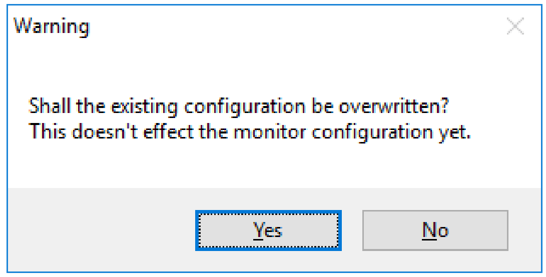
1. Select one of the configuration options:
   - **with the "Default" configuration**
     The default configuration is loaded as a basis for further parameter settings.
   - **with the configuration of another monitor**
     Chose another monitor from the list field to transfer its parameters to the new monitor. If there is no further monitor available, this item is gray shaded.
   - **with a saved configuration**
     Click **Select configuration** to open a file browser to open a stored configuration file (file extension *.mcfg).
   - **with a configuration from a project**
     Click **Select project** to open a file browser to open a stored project (file extension *.pcfg). With the following list field, select one configuration out of all configurations in this project.

Figure 5-18: Monitor initialization



2. Click **OK** to confirm the choice.
3. A warning message appears before already existing configuration parameters are overwritten. (see Figure 5-19). Confirm the safety request.

Figure 5-19: Warning Monitor initialization



Print

Click **Print** to print the configuration of the chosen monitor, for example, for documentation or archiving purposes.

Service report

Click **Service report** → **Create** to generate a service report containing the configuration parameters and all current status information. This report can then be stored (file extension *.srpt) and sent to a service center to ease troubleshooting.

Indication monitor status and monitor configuration

The two following figures show the monitor status view (see Figure 5-20) and the monitor configuration menu (see Figure 5-21). Click on the corresponding tabs to switch between **Status** and **Configuration**. View Monitor-Status describes the monitor status indication more detailed. For description of the individual tabs of the monitor configuration see Enter/edit parameters.

Figure 5-20: Status

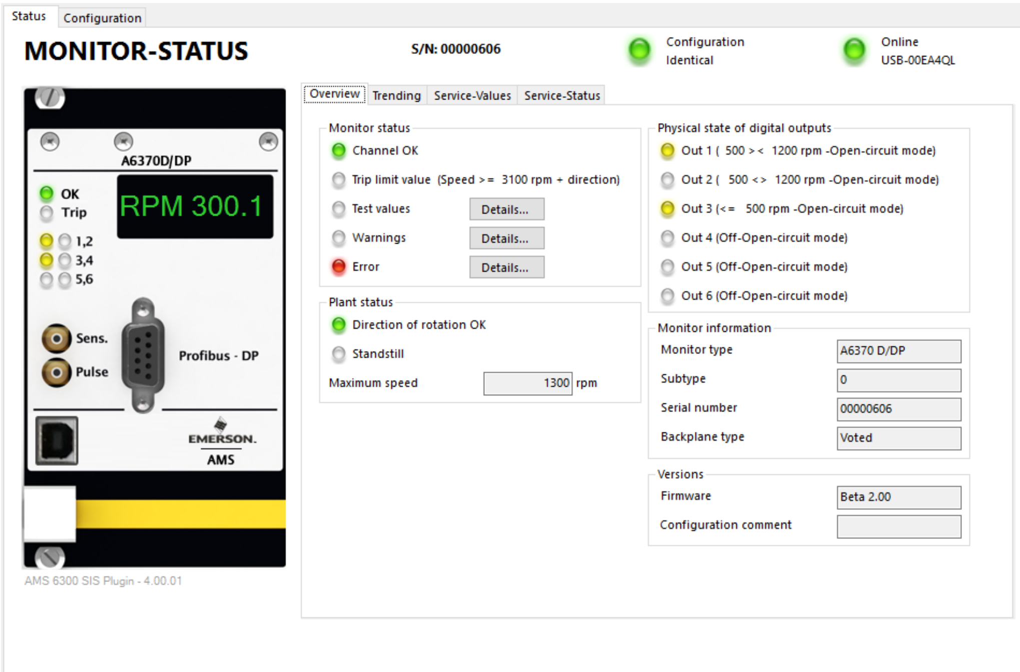
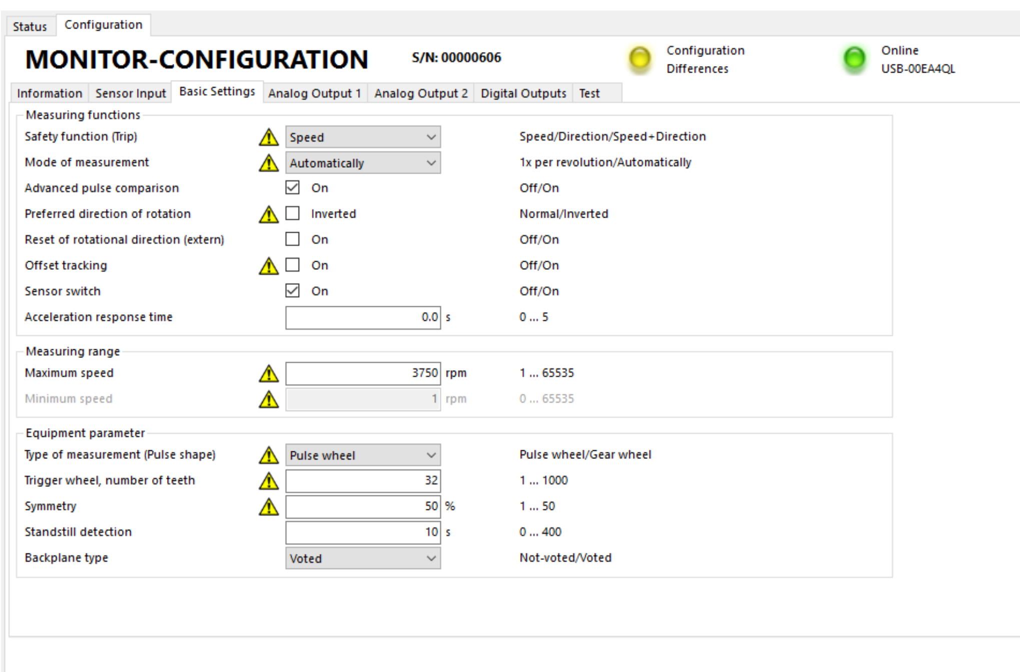


Figure 5-21: Configuration



5.3.3 Configuration - offline

In the offline operation (without a connection between computer and A6370 monitor), prepare and store parameter sets as configuration files on the computer. At any time later, with an existing connection between computer and monitor, load the configuration files to the monitor. The proceeding for the creation of the configuration is identical to the proceeding for online configuration and is described in Configuration - online.

Note
Without communication to the monitor, some of the direct commands of menu **Monitor** cannot be executed.

5.3.4 Configuration - online

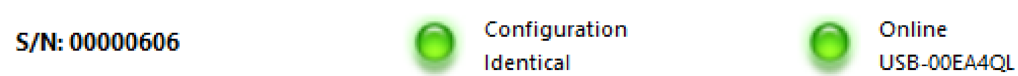
Connect the monitor

After the configuration software is started and the USB connection between a AMS 6300 SIS monitor and the configuration computer is made, the software automatically establishes the connection to the monitor and opens the monitor status.

Note
It is not necessary to make any settings in the monitor or in the configuration software for the communication through the USB interface.

After the successful start of the communication, the configuration parameters currently stored in the monitor are loaded automatically. In the top right part of the window (Figure 5-22) the status of the online connection, the status of the configuration, and the serial number of the monitor is displayed.

Figure 5-22: Status configuration, online connection, and serial number



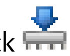
Status	LED state	Description
Configuration	yellow	The configuration parameters in the computer's working memory and in the monitor are not identical.[1]
	green	The configuration in the computer's working memory is identical to the configuration in the monitor.[1]
	gray	Configuration status is unknown.
Online connection	red	Online connection is disturbed.
	green	Properly working online connection.

1 *The result of this comparison is also indicated with a text message: " Configuration Identical" or "Configuration Differences".*

Enter/edit parameters

Editing of configuration parameters is made in the computer's working memory. This applies even if a monitor is connected to the computer and if this monitor is in the online mode.

Select the **Configuration** tab to switch the view from the monitor-state view to the monitor-configuration view. Enter and edit the parameters on this tab.

After entry of the parameters, click  in the symbol bar or **Monitor** → **Configuration** → **Send** to load the parameters into the monitor (see Configuration data send and receive).

Input and modification of parameters requires the login of a user with a corresponding authorization. Click **User** → **Login** and login with the following credentials:

User name:	Admin
Password:	3637766

Emerson recommends to crate an account for every user. For more details on the user administration see User management.

Plausibility check

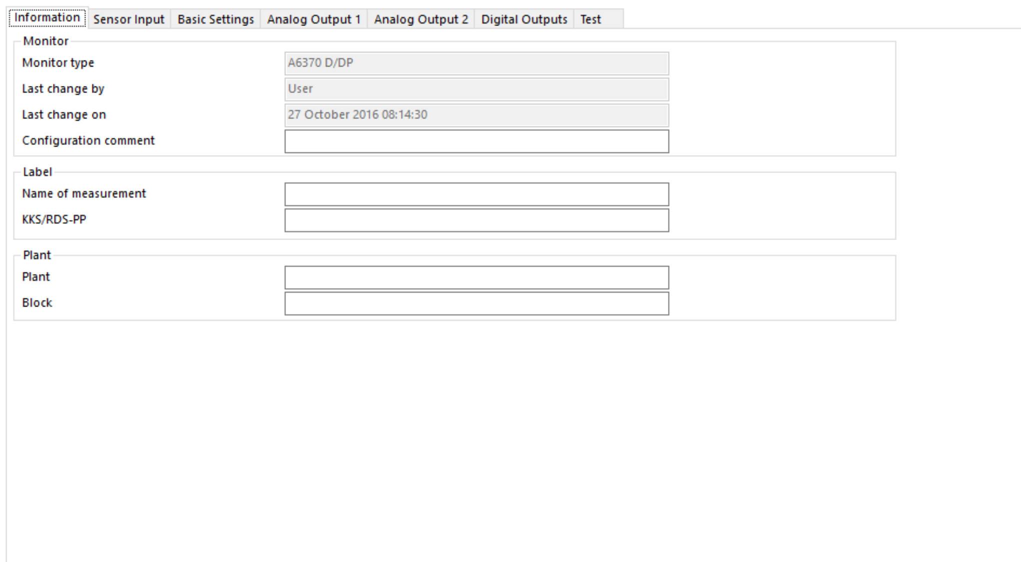
Inconsistent settings are indicated below the tabs. As long as an error message is indicated, the configuration cannot be loaded into the monitor. The error message contains instructions to correct a faulty parameter input (see Figure 5-23).

Figure 5-23: Error message plausibility check

Information

Enter here the general data of the configuration.

Figure 5-24: Information



Group Monitor

Monitor type

The entry in this field shows the predefined or chosen monitor type. The entry cannot be changed here.

Last change by

The entry in this field shows the name of the user who last made and saved parameter changes at this configuration. The entry cannot changed here.

User name and time of the modification are actualized and saved when a modified configuration was accepted and taken over.

Last change on

The entry in this field indicates date and time (PC time) when the last changes to this monitor configuration is made and stored. The entry cannot changed here.

Configuration comment

Enter a comment on the configuration in this field. This comment is stored together with the configuration parameters in the monitor. The comment may have a maximum length of 40 characters.

Group Label

Name of the measurement

Enter here a designation for the measurement such as "Speed measurement channel A". The maximum length for the text is 40 characters. This name is added to the monitor name in the project tree instead of the serial number. Without an entry here, the monitor name contains the serial number.

KKS/RDS-PP

Enter here the KKS/RDS-PP number according to the power plant identification system under which sensor or measuring chain are documented in the project documentation. This designation is stored in the monitor and serves as identification. The maximum length for the KKS/RDS_PP text is 20 characters.

Group Plant

Plant

Enter here the designation for the factory where the monitoring system is installed. The maximum length for the text is 40 characters.

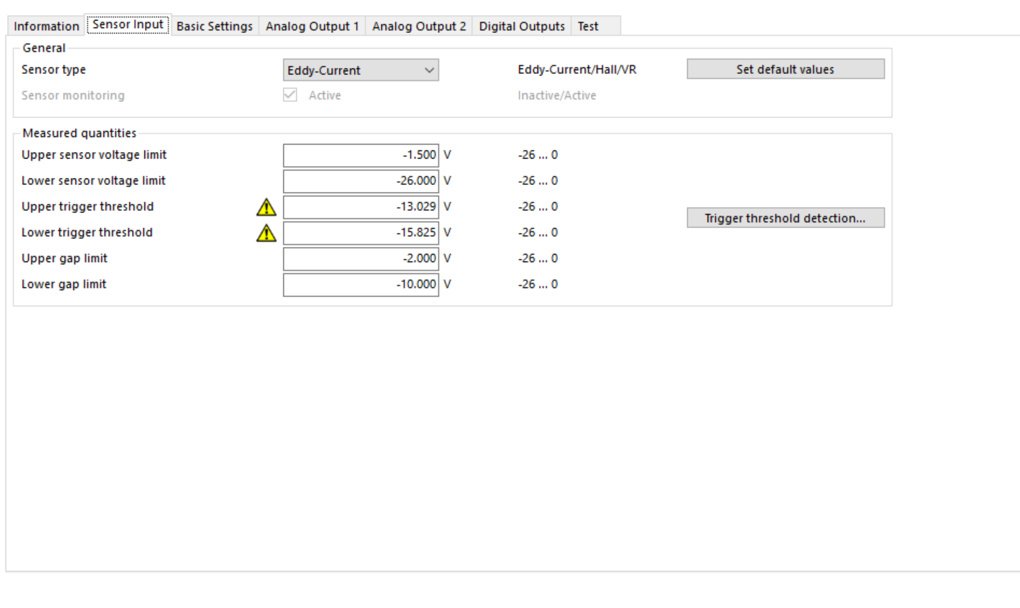
Block

Enter here the designation for the turbine stage where the monitoring system is installed. The maximum length for the text is 40 characters.

Sensor Input

Configure here the connected sensor. All details of this tab regarding levels and trigger thresholds are related to the original input signal. The sensor signal socket **Sens.** on the front plate of the monitor provides the absolute value of the original input signal of the connected sensor (Hall effect sensor or eddy current measuring chain) attenuated by factor 0.15. There is no signal at this socket if a VR sensor is connected.

Figure 5-25: Sensor Input



Group General

Sensor type

Select the connected sensor type form this list field. Depending on the selection, different limit input fields of group **Measured quantities** are enabled. The following sensor types are available:

- **Eddy-Current**
  Choose **Eddy-Current** if an eddy current sensor is connected.

- **Hall**
  Choose **Hall** if a Hall effect sensor is connected.
- **VR**
  Choose **VR** if a variable reluctance sensor is connected

Sensor monitoring

The checkbox **Sensor monitoring** is available when **Hall** or **VR** has been selected as sensor type.

Place a checkmark in the box to activate the supervision of the connected sensor. Eddy current sensors are always supervised. When activating this function for Hall effect sensors, ensure that the necessary resistance network is connected to the sensor input. See Sensor connection.

At VR sensors: The channel supervision only checks whether a VR sensor is connected or not. This supervision is active when a checkmark is placed in box **Sensor Input** → **Sensor monitoring** and machine standstill has been detected.

Click **Set default values** to set the values in group **Measured quantities** to the default values according to the selected sensor. Values not corresponding to the selected sensor are red colored.

Group Measured quantities

Upper sensor voltage limit and **Lower sensor voltage limit**

Define here the limit for the sensor supervision. The sensor input voltage must be within the defined range. If the sensor voltage is out of this limits Channel OK is switched off. For more details see Channel OK Channel supervision and Figure 5-27. See Table 5-1 for recommended sensor voltage limits.

Table 5-1: Recommended limit values

Sensor type	Upper sensor voltage limit	Lower sensor voltage limit	Explanation
Eddy current sensor	-1.5 V (range -2 V to -18 V)	-26 V (range -2 V to -18 V)	The upper sensor limit value must be lower than the maximum possible sensor level. The lower sensor limit value must be higher than the minimum possible sensor level. This avoids the switching off of Channel OK if the sensor detects a tooth gap.

Table 5-1: Recommended limit values *(continued)*

Sensor type	Upper sensor voltage limit	Lower sensor voltage limit	Explanation
Hall effect sensor[1]	5 V	18.5 V	Channel OK is switched off if the input voltage is within the defined range. Between 5 V and 18.5 V, for example. Channel OK is switched on if the input voltage is out of the defined range. Below 5V or above 18.5 V, for example. **Note** Ensure that the resistance network has been connected to the sensor input. Otherwise the Channel OK supervision does not work.

1 *Only if **Sensor monitoring** has been activated.*

These parameters are grayed out if **VR** has been selected for parameter **Sensortyp**.

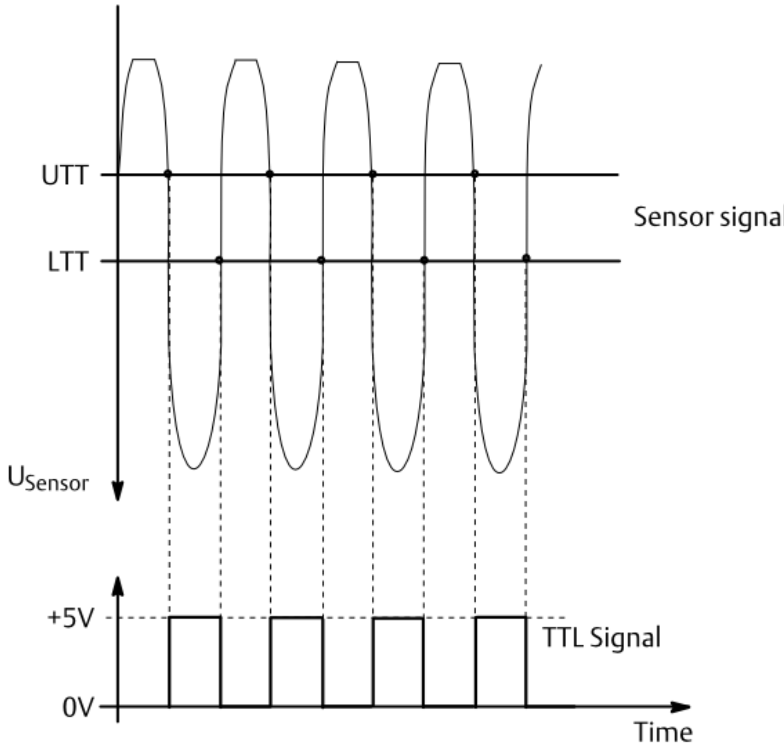
Note
At VR sensors, sensor voltage limits are not used for the sensor monitoring. The channel supervision only checks whether a VR sensor is connected or not. This supervision is active when a checkmark is placed in box **Sensor monitoring** and machine standstill has been detected.

Upper trigger threshold and **Lower trigger threshold**

The monitor works with a TTL signal (0 to 5 V) generated from the input signal and the configured trigger thresholds. When the input signal falls below the upper trigger threshold (UTT), the TTL signal is switched to +5 V. When exceeding the lower trigger threshold (LTT), the TTL signal is switched to "0". See Figure 5-26.

Click **Trigger threshold detection** to open the dialog for the automatic trigger threshold detection. See Definition of the trigger thresholds how to define trigger levels.

Figure 5-26: TTL signal



These parameters are grayed out if **VR** has been selected for parameter **Sensortyp**.

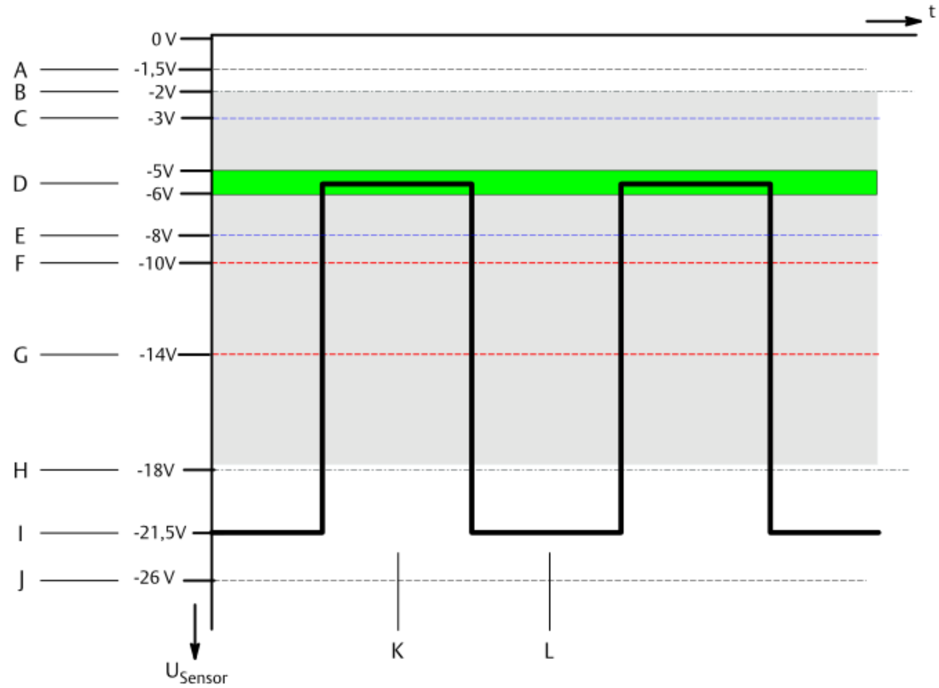
Upper gap limit and **Lower gap limit**

These parameters serve the supervision of the signal level to indicate a warning message when the distance between sensor and trigger wheel has changed in an inadmissible way.

The gap supervision checks the signal level while the sensor is facing a tooth of the trigger wheel. Set the gap limits in such way that during installation of the sensor the maximum signal level is within the gap limits (see Figure 5-27). The maximum signal level is reached when the sensor faces the tooth of the trigger wheel. A gap warning is indicated when the signal level leaves this range.

During the measurement the minimum and maximum distance between sensor and trigger wheel is measured. The output of a gap warning is independent from **Channel OK**.

Figure 5-27: Example signal form with trigger thresholds and limit values for sensor type PR 6423



Signal range: -2 to -18 V

Distance sensor - tooth: approximately 0.90 - 1.0 mm (sensor PR 6423)

Adjusted to approximately -5.5 V over tooth

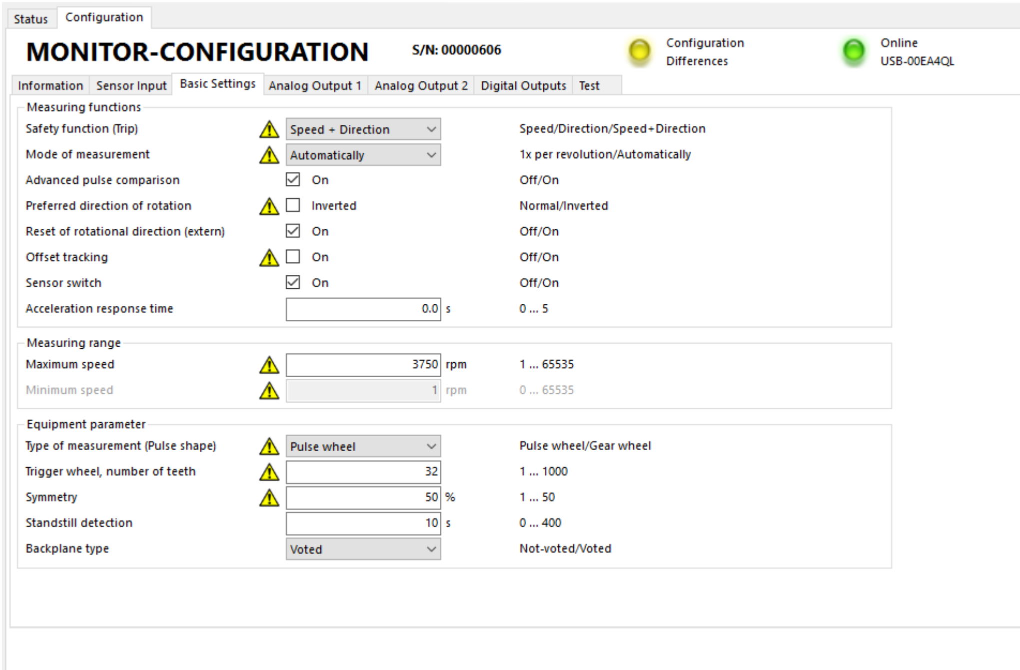
A. *Upper sensor voltage limit*
B. *Linear measuring range: lower limit*
C. *Upper gap limit*
D. *Sensor adjustment range*
E. *Lower gap limit*
F. *Upper trigger threshold (UTT)*
G. *Lower trigger threshold (LTT)*
H. *Linear measuring range: upper limit*
I. *Maximum output amplitude of an eddy current measuring chain*
J. *Lower sensor voltage limit*
K. *Signal maximum = tooth*
L. *Signal minimum = tooth gap*

These parameters are grayed out if **VR** or **Hall** has been selected for parameter **Sensortyp**.

Basic Settings

Enter here the basic setting for the measurement.

Figure 5-28: Basic Settings



Group Measuring functions

Safety function (Trip)

Define here the safety function of the system. When the condition for the selected safety function is met, the trip will be released. The trip signal is routed to the relay logic on the backplane. Choose from the following functions:

- **Speed**
  As soon as the trip limit value, defined in tab **Digital outputs** is reached, the trip for the monitor is released.
- **Direction of rotation**
  When the detected rotational direction is opposite to the normal rotational direction, the trip for the monitor is released.
- **Speed + Direction**
  When the conditions for at least one of the two safety functions are met, the trip for the monitor is released.

Note
The safety functions **Direction of rotation** and **Speed + Direction** can not be selected if **VR** (variable reluctance sensor) has been selected for parameter **Sensor Input** → **Sensor type**. The detection of rotational direction is not possible with variable reluctance sensors.

Mode of measurement

Define here the measuring mode. The selected measuring mode influences the measurement time. Choose from the following measuring modes:

- **1x per revolution**
  The monitor measures the speed once per revolution. This mode is recommended when variations in the measurements are expected, and when acceleration measurements shall be performed. See Table 5-2 for the maximum measurement time depending on the selected measuring mode. At a machine speed of 3000 rpm, for example, the maximum measurement time is 40 ms.
- **Automatically**
  This measuring mode is the preferred mode for most of the measurements. See Table 5-2 for the maximum measurement time. This measuring mode permits a more accurate measurement at higher speeds.

Table 5-2: Maximum measurement time

Measurement mode	Period time	Measurement time
1 * per revolution	Arbitrary	≤2 x $t_{revolution}$[1]
Automatic	>10 ms	≤2 x t_{period}[2]
	≤10 ms	≤20 ms

1 *$t_{revolution}$: Time of one rotation*
2 *t_{period}: Period time of the input signal*

This parameter also influences the reaction time of safety function **Speed**. The AMS 6300 SIS safety manual contains further information on this.

Advanced pulse comparison

Place a checkmark in this box to activate the advanced pulse comparison. See Pulse comparison for further information.

This parameter is grayed out if **VR** has been selected for parameter **Sensor Input** → **Sensor type**.

Preferred direction of rotation

Use this box to define the preferred rotational direction. Place a checkmark in the box to define "inverted to the normal direction" as the preferred rotational direction. See Detection of rotational direction for further information on the detection of rotational direction.

This parameter is grayed out if **VR** has been selected for parameter **Sensor Input** → **Sensor type**.

Reset of rotational direction (external)

Place a checkmark in this box to enable the external reset of the rotational direction. With the box checked, a reset is possible through the digital input **Reset latch** (see Digital inputs). Alternatively, a reset can also be carried out with the configuration software (**Monitor** → **Reset rotation**). The indication of the rotational direction is reset to the selected preferred rotational direction. See Detection of rotational direction for further information on the detection of rotational direction.

This parameter is grayed out if **VR** has been selected for parameter **Sensor Input** → **Sensor type**.

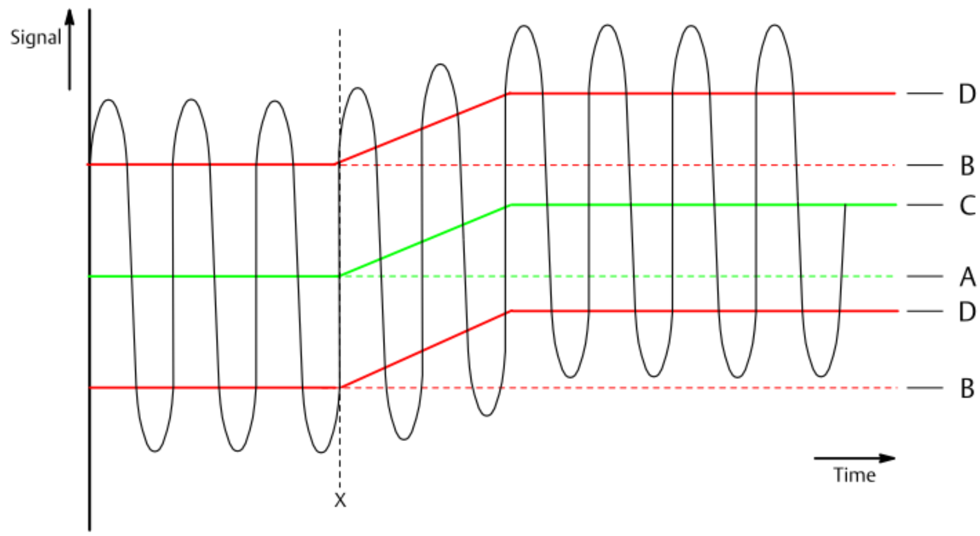
Offset tracking

Place a checkmark in the check box to activate offset tracking.

Note
With safety function **Speed + Direction** or **Direction of rotation** Offset tracking cannot be used.

Offset tracking serves the adaptation of the trigger thresholds depending on changes of the DC signal component caused by radial shaft displacements, for example. Figure 5-29 shows the principle of the offset tracking. Until point **X**, the trigger thresholds are within the range of the input signal. At point **X**, the DC component of the input signal rises to the level marked with **C**. The signal leaves the range of the trigger thresholds **B**. At that very moment, a detection of input pulses is not possible anymore. With activated offset tracking the trigger thresholds are correspondingly adapted to the change of the input signal **D**.

Figure 5-29: Diagram offset tracking



X: Initial point of the change

A. DC voltage component
B. Trigger thresholds without offset tracking
C. DC voltage component after change
D. Trigger thresholds with offset tracking

This parameter is grayed out if **VR** or **Hall** has been selected for parameter **Sensor Input → Sensor type**.

Sensor switch

Place a checkmark in the box to activate the sensor switchover. This parameter is assigned to safety functions **Direction of rotation** and **Speed + Direction** with **Pulse wheel** selected for **Type of measurement (pulse shape)**. These safety functions use two channels of the AMS 6300 SIS for detecting the rotational direction. If a sensor fault occurs at one measurement channel with activated sensor switchover, the remaining third sensor is switched to this measurement (see Detection of rotational direction).

Note
All functions, exclusively assigned to the detection of rotational direction, measure only up to a signal frequency of 166 Hz. At higher speeds the detected rotational direction is "frozen" and activated again with signal frequencies below 166 Hz.

This parameter is grayed out if **VR** has been selected for parameter **Sensor Input** → **Sensor type**.

Acceleration response time

Because of a short measuring time, the indication of acceleration values may vary. Define a time constant at a range of 0 to 5 seconds to smoothen the acceleration indication. The time constant defines the time that it takes for the system to reach 63% of the asymptotic end value. After a delay of 5 times **Acceleration response time** the asymptotic end value is reached. This parameter influences current outputs assigned to the characteristic value **Acceleration** and digital outputs assigned to function **... Acceleration limit value ...**. For stable measurements Emerson recommends using a time constant >0.1 seconds and the measuring mode **1 x per revolution**. If this parameter is set to "0", the indication is not smoothed.

Group Measuring range

Maximum speed

Enter here the maximum speed for the measurement. The voltage range for the analog comparison is scaled on this speed range (0 to **Maximum speed**). Beside this, the maximum value for the trip level depends on this parameter.

Note
The maximum speed value for the trip level depends on this parameter. The trip limit value must be at least 67 % of the maximum speed.

Minimum speed

This entry field is only active if **VR** has been selected for parameter **Sensor Input** → **Sensor type**. Enter here the minimum speed for the measurement. The value must be between 0 and 30% of the maximum speed (parameter **Maximum speed**). Use this parameter if the machine can not be started because of an analog error.

The signal amplitude, generated by VR sensors, depends mainly on the machine speed. The signal amplitude of the three sensors can be different because of slightly different mounting distances between the VR sensors and the trigger wheel. This can cause an analog error at a slow rotating machine.

Group Equipment parameter

Type of measurement (Pulse shape)

Certain functions such as detection of the rotational direction and pulse comparison depend on the shape of the measured signal. The signal shape depends on the design of the trigger wheel. Select here the type of the user trigger wheel shape.

- Choose **Pulse wheel** if the used trigger wheel has a rectangular tooth profile.
- Choose **Gear wheel** if the teeth of the used trigger wheel have chamfered flanks.

Note
Choose **Pulse wheel** if safety function **Direction of rotation** or **Speed + Direction** has been chosen.

Trigger wheel, number of teeth

Enter here the number of teeth of the used trigger wheel. This number together with the signal frequency is used for the calculation of the speed. If only one trigger mark (groove or tooth) is available, enter "1". The maximum number of teeth is 1000.

Symmetry

Enter here the pulse width ratio of the input signal. This parameter is used together with the maximum speed (parameter **Maximum speed**) to adjust the noise pulse filter. The filter has the widest passband at a symmetry setting of 1%.

Use the TTL signal to define the pulse width ratio. Measure the TTL signal at arbitrary speeds with an oscilloscope at the socket **Pulse** (see Socket Pulse). Emerson recommends to check the pulse width ratio at nominal speed and to adjust it if necessary as the pulse width at nominal speed is crucial for the noise pulse filter.

Note
If **Pulse wheel** has been chosen for parameter **Type of measurement (Pulse shape)**, set the parameter **Symmetry** to 50%. The actual signal symmetry has to be checked at front socket **Pulse** (see Socket Pulse) and may vary within a range of 40% to 50%.

The maximum permissible tolerance at nominal machine speed is -20% of the entered symmetry value. Wider respectively longer pulses cause higher symmetry values than the entered symmetry value. These pulses are not filtered. Smaller respectively shorter pulses cause symmetry values lower than the entered value. All pulses with a symmetry value below the entered value minus 20% are identified as noise pulses.

Example: With an entered symmetry of 20% the actual symmetry may not be below 16%, measured at the front socket **Pulse**, at nominal speed. All pulses with a symmetry above the limit of 16% are used for speed calculation, respectively detection of rotational direction. Pulses below this limit of 16 % are identified as noise pulses and filtered out. Above this limit the symmetry of the input signal may vary.

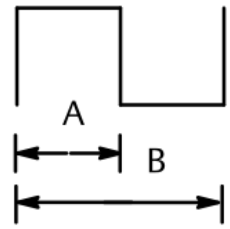
Figure 5-30 and Figure 5-31 show symmetry examples based on the TTL signal. The period portion, which is smaller than 50% must be used to define the symmetry as the entry range of the parameter is limited to 1 to 50%. This could be either pulse width or pulse pause. Calculate the symmetry with the following formula.

Symmetry = Period portion$_{\leq 50\%}$ * 100% / (Pulse width + Pulse pause)

Example with Period portion$_{\leq 50\%}$ (pulse width) = 4 ms and Pulse width + Pulse pause (period duration) = 20 ms:

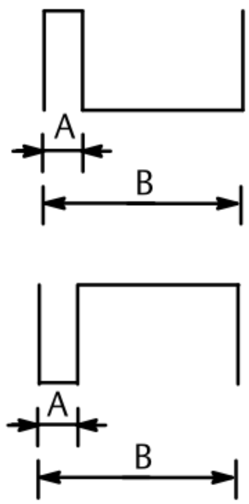
Symmetry = 4 ms * 100% / 20 ms = 20%

Figure 5-30: Diagram symmetry 50% - TTL signal



A. *Pulse width = Pulse pause (B-A)*
B. *Pulse width + Pulse pause*

Figure 5-31: Diagram symmetry 20% - TTL signal



A. *Period portion <50%*
B. *Pulse width + Pulse pause*

The symmetry value always based on the period portion <50%.

At machine standstill determine the expected pulse width ratio by means of the trigger wheel dimensions. The symmetry declaration is based either on the tooth width or on the gap width depending on which width is less than 50% related to the pitch. Figure 5-32 to Figure 5-36 show symmetry examples based on a trigger wheel with rectangular tooth profile and with chamfered flanks. Calculate the symmetry with the following formula.

Tooth width ≤50%:

Symmetry = Tooth width$_{\leq 50\%}$ * 100% / (Tooth width $_{\leq 50\%}$ + Gap width)

Gap width ≤50%:

Symmetry = Gap width$_{\leq 50\%}$ * 100% / (Gap width$_{\leq 50\%}$ + Tooth width)

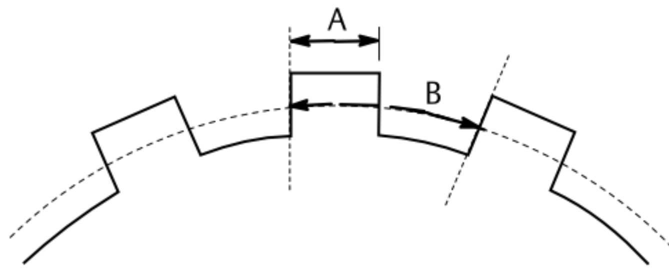
Example with Tooth width ≤50% = 9 mm and Tooth width + Gap width = 45mm:

Symmetry = 9 mm * 100% / 45 mm = 20%

Note

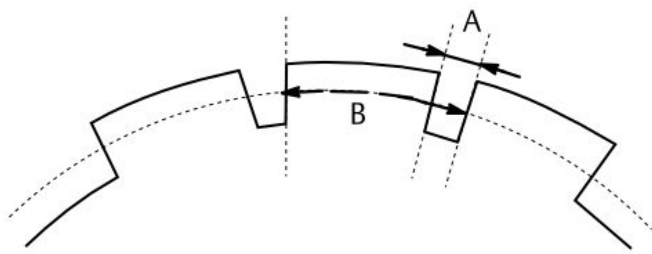
Set the symmetry to 1% if the calculated symmetry is less than 10%. The noise pulse filter has the widest passband at this setting. This is valid, independently if the symmetry has been calculated by means of the TTL signal or based on the trigger wheel dimensions. Set the symmetry to the same value for all three channels.

Figure 5-32: Trigger wheel with rectangular tooth profile - symmetry 50%



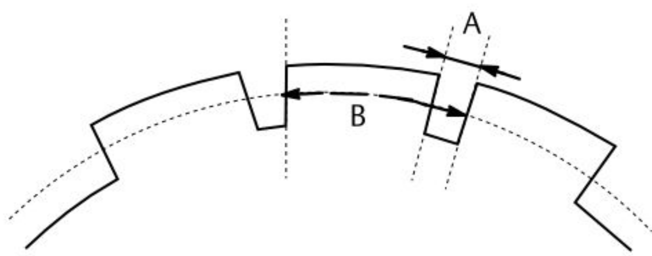
A. *Tooth width = Gap width (B-A)*
B. *Tooth width + Gap width*

Figure 5-33: Trigger wheel with rectangular tooth profile - symmetry 20% (tooth < gap)



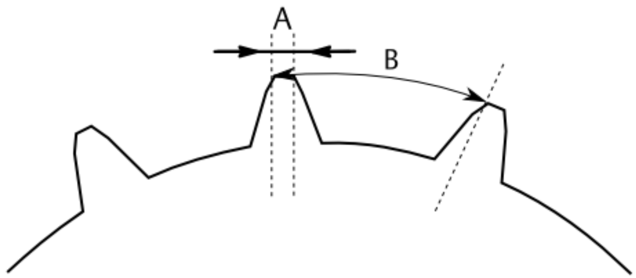
A. *Tooth width < Gap width (B-A)*
B. *Tooth width + Gap width*

Figure 5-34: Trigger wheel with rectangular tooth profile - symmetry 20 (gap < tooth)



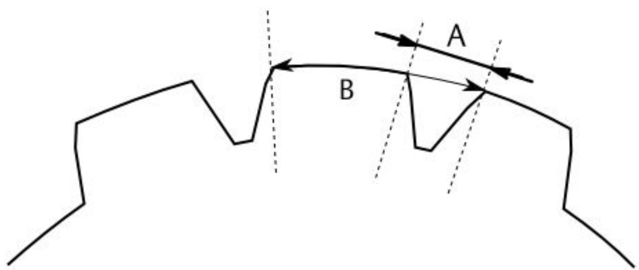
A. *Gap width < Tooth width (B-A)*
B. *Tooth width + Gap width*

Figure 5-35: Trigger Wheel with chamfered flanks - symmetry 10%



A. *Tooth width < Gap width (B-A)*
B. *Tooth width + Gap width*

Figure 5-36: Trigger Wheel with chamfered flanks - symmetry 30%



A. *Gap width < Tooth width (B-A)*
B. *Tooth width + Gap width*

Standstill detection

Enter here the time for the Standstill detection. It defines how many seconds must elapse before standstill is indicated after the last pulse is detected at the signal input. The configured standstill time must be longer than the time between two measured pulses with the running machine. Message **Standstill** is reset as soon as the next pulse is detected at the signal input. See Standstill indication for further information.

Note
This parameter does not define the standstill time of function **Standstill** on **Digital Outputs**.

Backplane type

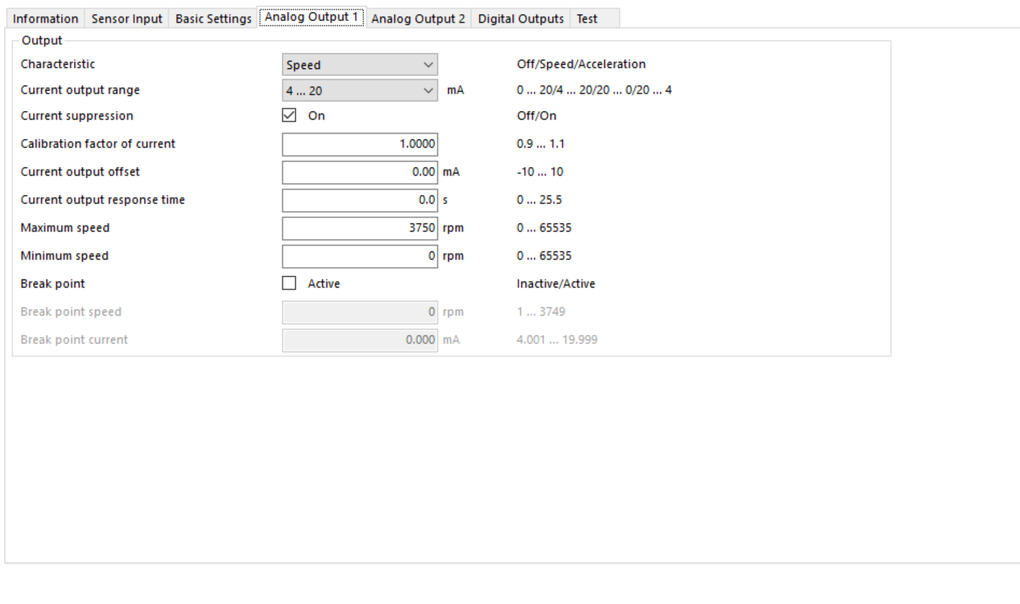
Select here the type of backplane used for the system.

- Voted
- Not-Voted

Ensure that this setting corresponds to the installed backplane (A6371 Trip Voted or A6371/10 Trip Not Voted). If the wrong type is entered here, the system indicates **Relay error** and switches off **Channel OK**.

Analog Output 1 and Analog Output 2

Figure 5-37: Analog output



Characteristic

Use this list field to assign the current output to a characteristic value. Select from the following options:

- **Off**
  The current output is not used and is deactivated.
- **Speed**
  The current output is assigned to characteristic value "Speed".
- **Acceleration**
  The current output is assigned to characteristic value "Acceleration".

Depending on the selected option, the following parameters on this tab are enabled or adapted.

Current output range

Use the list field to define the current output range. Select form the following ranges:

- **0 ... 20 mA**
- **4 ... 20 mA**
- **20 ... 0 mA**
- **20 ... 4 mA**

For the ranges **4 ... 20 mA** and **20 ... 4 mA**, the function **Current suppression** can be enabled.

Current suppression

Place a checkmark in this box to activate the current suppression for the current output ranges 4 to 20 mA and 20 to 4 mA. When current suppression is activated, the current output is switched to 0 mA if **Channel OK** is switched off. With activated current suppression, the current output can be used to indicate whether the channel is OK or not.

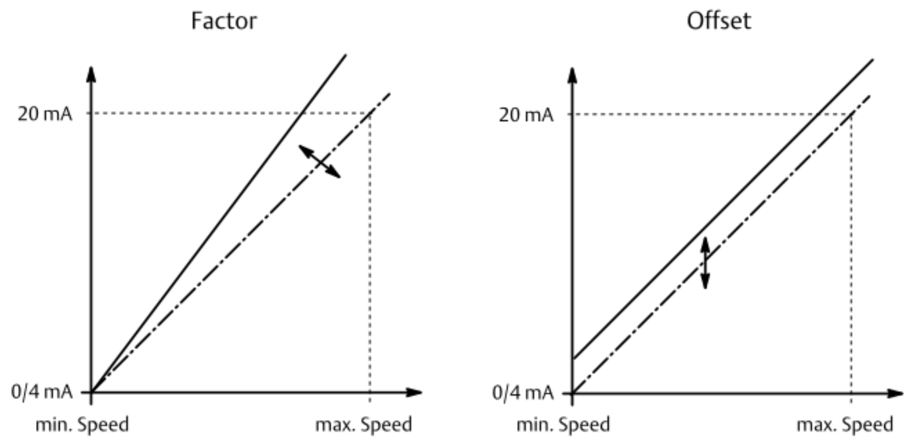
Calibration factor of current

Enter here a factor at the range of 0.9 to 1.1 for the calibration of the current output. This factor influences the slope of the output curve (see Figure 5-38).

Current output offset

Enter here a current output offset at the range of ±10 mA. Use this offset for the zero point calibration (see Figure 5-38).

Figure 5-38: Diagram current output calibration



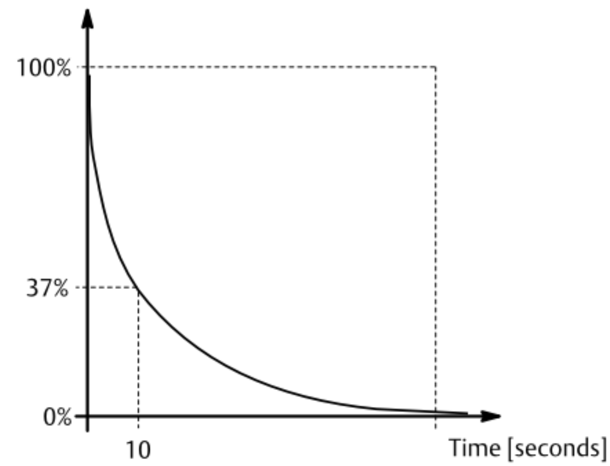
Current output response time

To smooth the output current, enter here a time constant at the range of 0 to 25.5 seconds. An input of "0" effects no change in the output current. The time constant causes a slow change of the current at fast changes of the measuring value.

If a time constant of, for example, 10 seconds is chosen, for example, and if the measuring value changes suddenly from 100% to 0, it will last approximately 10 seconds till the current has declined by 63 %. The change curve follows an E-function, this means at a slower increasing – respectively decreasing amplitude response (see Figure 5-39).

Note
In case of fault functions and with activated current suppression, the configured function current output response time has no effect. The current is set to "0" without smoothing.

Figure 5-39: Diagram current output smoothing



Maximum speed or Maximum acceleration

Depending on the setting of parameter **Characteristic**, define here the end value for the asymmetric range for the scaling of the current output on **Speed** (see Figure 5-40) or for the symmetric range for the scaling of the current output on **Acceleration** (see Figure 5-41). If **Acceleration** was chosen for parameter **Characteristic**, this parameter defines the start and end value of the symmetrical range around 0 rpm/s. If the acceleration is 0 rpm/s, the current output shows 10 mA respectively 12 mA. In this way it is possible to output positive and negative acceleration values through the current output.

Figure 5-40: Diagram current output scaling - speed

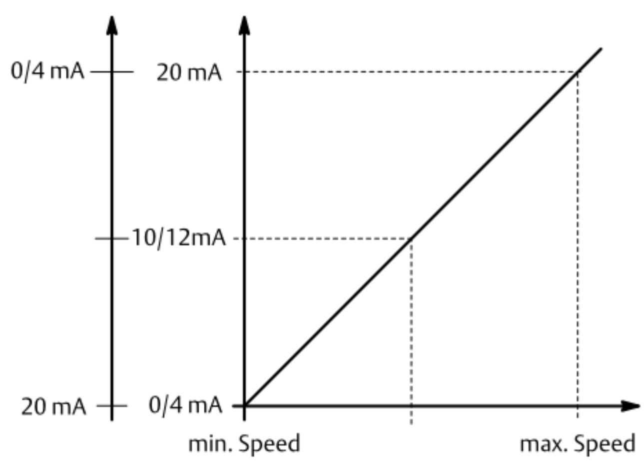
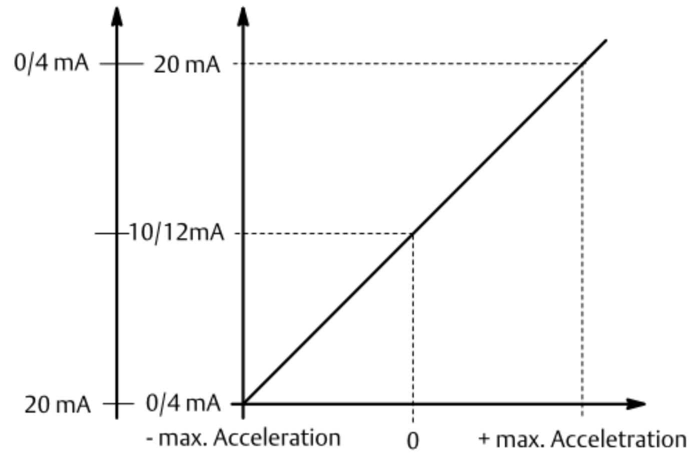


Figure 5-41: Diagram current output scaling - acceleration



Minimum speed

Define here the start point of the range for scaling the current output (see Figure 5-40). The current output is proportional to the speed.

Break point

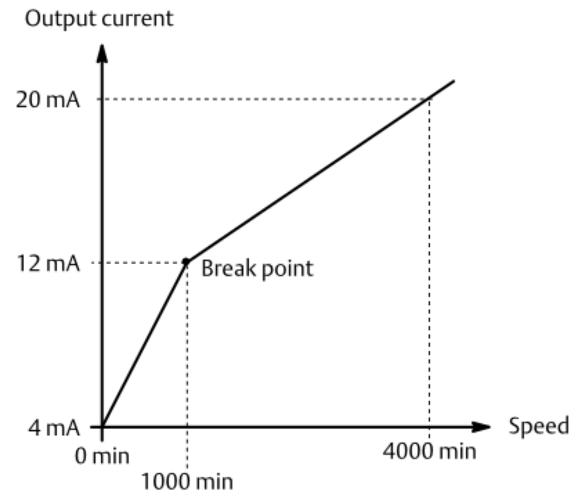
Place a checkmark in this box to activate the break point function. With activated break point, the current output range is divided in two ranges with different gradients. The parameters **Break point speed** and **Break point current** are enabled.

*Break point speed **and** Break point current*

Use these parameters to define the break point. See Figure 5-42 for a break point example with speed range 0 to 4000 rpm, and a current output range of 4 to 20 mA. The speed range 0 to 1000 rpm shall be scaled on half the current range. This effects a better resolution of the speed range 0 to 1000 rpm.

Note
The break point function is not available if **Acceleration** is selected for parameter **Characteristic**.

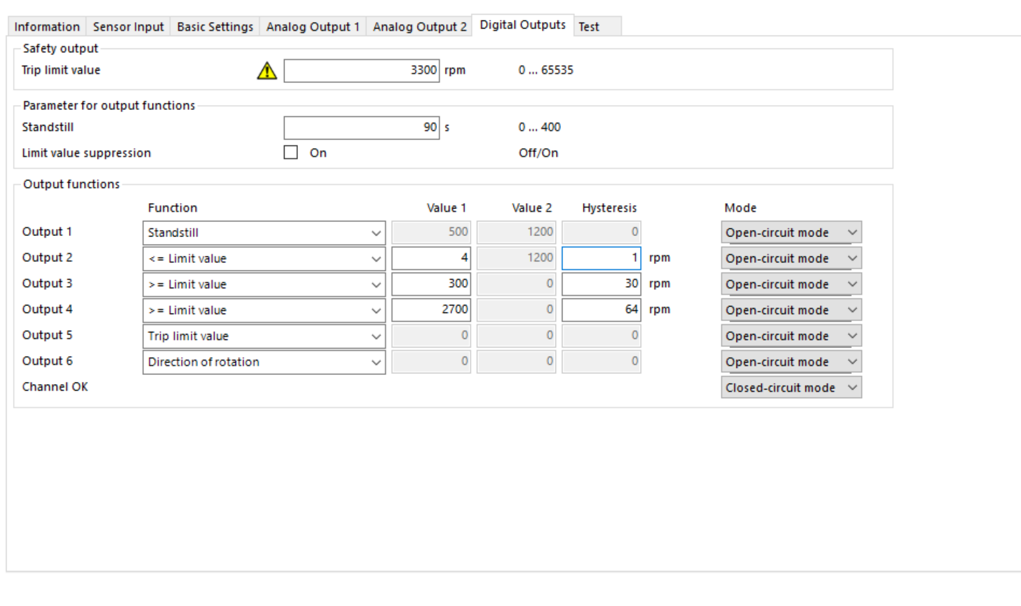
Figure 5-42: Break point example



Digital Outputs

Use this tab to configure the 6 function outputs, output Channel OK, and the safety output.

Figure 5-43: Digital Outputs



Group Safety output

Trip limit value

Enter here the limit value for the overspeed trip. This value must be at least 67% of the entered maximal speed (**Basic Settings** → **Maximum speed**). The trip output is switched when the speed value of the channel reaches the limit value or if Channel OK is switched off.

Trip limit $value_{min}$ = Maximum speed * 0.67

Example with a maximum speed = 4000 rpm:

Trip limit $value_{min}$ = 4000 rpm * 0.67 = 2680 rpm

In this example, the trip limit must not be lower than 2680 rpm and must not exceed 4000 rpm.

Group Parameter for output functions

Standstill

Enter here the standstill time. It defines how many seconds must elapse before standstill is indicated through a function output with function **Standstill** after the last pulse is detected at the signal input. The configured standstill time has to be longer than the time between two measured pulses at the lowest speed. The message **Standstill** is reset as soon as a new pulse is detected at the signal input.

Limit value suppression

Place a checkmark in this box to activate the limit suppression for outputs configured with the following functions:

- >= Limit Value
- <= Limit Value
- >= Limit Value + Latch
- <= Limit Value + Latch
- Outside window
- Inside window
- >= Acceleration limit value
- <= Acceleration limit value
- >= Acceleration limit value + Latch
- <= Acceleration limit value + Latch
- Acceleration outside window

The function outputs assigned are suppressed, if Channel OK (OK) is not true.

If alarm channels are suppressed, the outputs are set to their default states and the relevant LEDs are switched off. The initial states of the outputs are defined by parameter **Digital Outputs** → **Mode**.

Group Output functions

Define here function, mode, and, if applicable, limit values for each of the six function outputs.

Function

Assign one of the following functions to the outputs:

Off

The function output remains in the initial state and is not switched. Define the condition of the initial state with parameter **Mode**.

>= Limit Value

The characteristic of the switch is increasing. The condition for the output is met when the speed of the channel reaches the defined limit value **Value 1**.

If the speed falls below the limit value minus hysteresis again, the alarm output is reset. Enter the hysteresis into the input field **Hysteresis**.

<= Limit Value

The characteristic of the switch is decreasing. The condition for the output is met when the speed of the channel falls below the defined limit value **Value 1**.

If the speed exceeds the limit value plus hysteresis again, the alarm output is reset. Enter the hysteresis into the input field **Hysteresis**.

>= Limit Value + Latch

The characteristic of the switch is increasing. The condition for the output is met when the speed of the channel reaches the defined limit value for this output. The alarm state is latched.

If the speed falls below the limit value again, reset the alarm by a reset latch command either through the digital input **Reset latch** (see Digital inputs) or through the configuration software (**Monitor** → **Reset latch**).

<= Limit Value + Latch

The characteristic of the switch is decreasing. The condition for the output is met when the speed of the channel falls below the defined limit value for this output. The alarm state is latched.

If the speed exceeds the limit value again, reset the alarm by a reset latch command either through the digital input **Reset latch** (see Digital inputs) or through the configuration software (**Monitor** → **Reset latch**).

Standstill

The function output indicates **Standstill** when no further signal pulse is detected after the configured standstill time has elapsed (see Standstill detection).

The output is reset as soon as a pulse is detected at the signal input again.

Direction of rotation

This function requires a certain arrangement of the sensors at the machine (see Adjustment and arrangement of sensors at the machine).

The output is switched when the measured rotational direction is inverted to the configured preferred rotational direction (**Basic Settings** → **Preferred direction of rotation**).

The output is reset when the machine turns at the preferred rotational direction again.

Reset the detected direction during standstill by a reset command through the configuration software (**Monitor** → **Reset rotation**). When the external reset of the rotational direction is activated (**Basic Settings** → **Reset of rotational direction (extern)**, a further option is to use the digital input **Reset latch** for the reset.

Sensor error

The indication of the check of the connected sensor. The output is set when an error has been detected at the connected sensor. The output is reset again, when the sensor fault has been eliminated.

Gap warning

The distance between connected sensor and trigger wheel is checked on an upper and a lower limit value. If the range, defined by the two limits is left, the function output is switched. The output is reset again when the distance is within the defined gap limits again.

Test value 1 active

The output is set as long as **Test value 1** is active. The output is reset again, when **Test value 1** is deactivated.

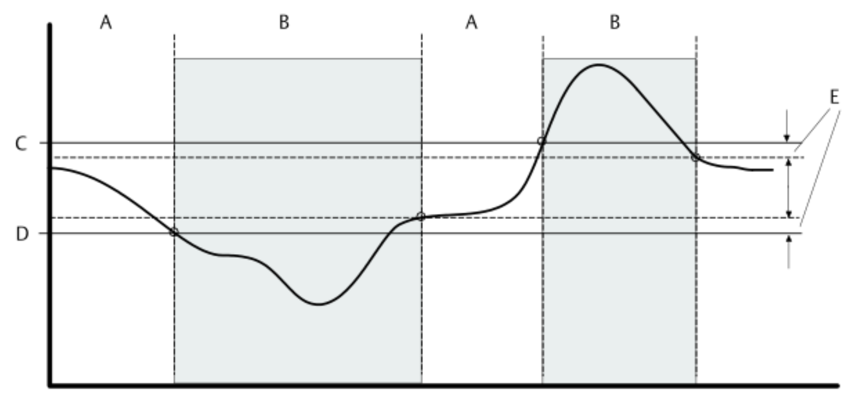
Test value 2 active

The output is set as long as **Test value 2** is active. The output is reset again, when **Test value 2** is deactivated.

Outside window

Define with limit value **Value 1** and limit value **Value 2** a limit window. The function output is set when the speed value leaves the window. See Figure 5-44.

Figure 5-44: Diagram limit monitoring Outside window



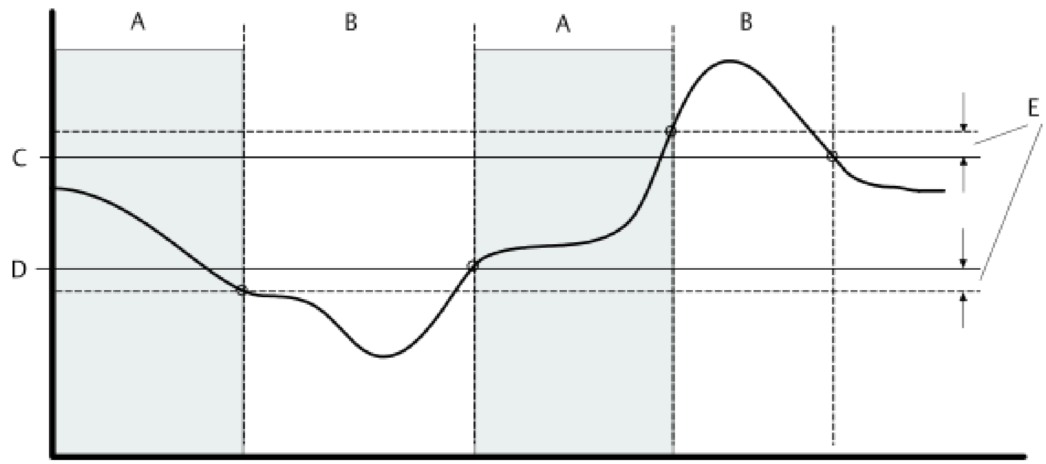
A. No alarm
B. Alarm activated
C. Value 2
D. Value 1
E. Hysteresis

The function output is in initial state (no alarm) as long as the measuring value is within the limits by considering the hysteresis values.

Inside window

Define with limit value **Value 1** and limit value **Value 2** a limit window. The function output is set when the speed value of this channel is within the window. See Figure 5-45

Figure 5-45: Diagram limit monitoring Inside window



A. Alarm activated
B. No alarm
C. Value 2
D. Value 1
E. Hysteresis

The function output is in initial state (no alarm) as long as the measuring value is outside the limits by considering the hysteresis values.

Temperature warning 55°C

The output is switched, when the temperature, measured with the internal temperature sensor, exceeds +55°C for more than 60 seconds.

Temperature warning 65°C

The output is switched, when the temperature, measured with the internal temperature, sensor exceeds 65°C for more than 60 seconds.

Trip limit value

This function behaves exactly like the trip function (see Trip limit value).

>= Acceleration limit value

The characteristic of the switch is increasing. The condition for the output is met when the acceleration reaches the defined limit value **Value 1**.

If the acceleration falls below the limit value minus hysteresis again, the alarm output is reset. Enter the hysteresis in input field **Hysteresis**.

<= Acceleration limit value

The characteristic of the switch is decreasing. The condition for the output is met when the acceleration falls below the defined limit value **Value 1**.

If the acceleration exceeds the limit value plus hysteresis again, the alarm output is reset. Enter the hysteresis in input field **Hysteresis**.

>= Acceleration limit value + Latch

The characteristic of the switch is increasing. The condition for the output is met when the acceleration reaches the defined limit value **Value 1**. The alarm state is latched.

If the acceleration falls below the limit value again, reset the alarm by a reset latch command either through the digital input **Reset latch** (see Digital inputs) or through the configuration software (**Monitor** → **Reset latch**).

<= Acceleration limit value + Latch

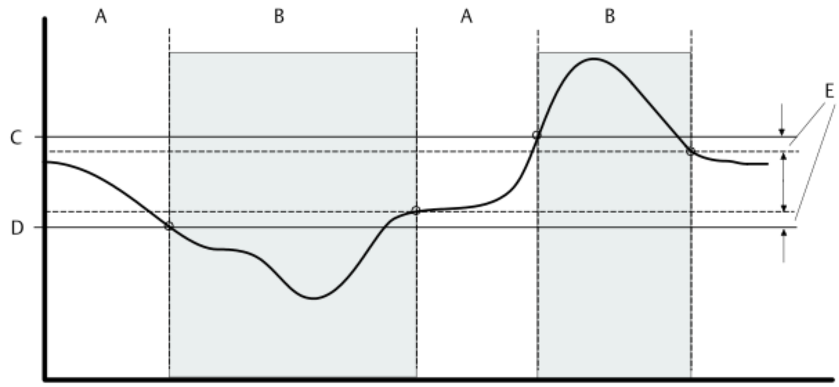
The characteristic of the switch is decreasing. The condition for the output is met when the acceleration falls below the defined limit value **Value 1**. The alarm state is latched.

If the acceleration exceeds the limit value again, reset the alarm by a reset latch command either through the digital input **Reset latch** (see Digital inputs) or through the configuration software (**Monitor** → **Reset latch**).

Acceleration outside window

Define with limit value **Value 1** and limit value **Value 2** a limit window. The function output is set when the acceleration leaves the window. See Figure 5-46.

Figure 5-46: Diagram limit monitoring Acceleration outside window



A. No alarm
B. Alarm activated
C. Value 2
D. Value 1
E. Hysteresis

The function output is in initial state (no alarm) as long as the measuring value is inside the limits by considering the hysteresis values.

Depending on the selected function, input fields **Value 1**, **Value 2** and **Hysteresis** are enabled.

Value 1 and **Value 2**

Enter here the limit value for functions with limit monitoring. The unit of the limit value for the function output is in [rpm] for the speed and in [rpm/s] for acceleration. Parameter **Value 1** must always be smaller than **Value 2**.

Hysteresis

Enter here the hysteresis. The hysteresis shall avoid an undefined switching of the assigned binary output, if the measuring value constantly moves around the limit value. The hysteresis value does only have an effect, when a limit value has been violated.

The threshold for resetting the function output is the limit value minus hysteresis for increasing switching characteristics and the limit value plus hysteresis at decreasing switching characteristics.

Mode

Select the operating principle for the corresponding function output and the Channel OK output from the list field.

- **Open-circuit mode**
  In **Open-circuit mode** the initial state of a function output means an output signal of 0 V and the active state (condition for the output is met) an output signal of +24 V.
- **Closed-circuit mode**
  In **Closed-circuit mode** the initial state of a function output means an output signal of +24 V and the active state (condition for the output is met) an output signal of 0 V.

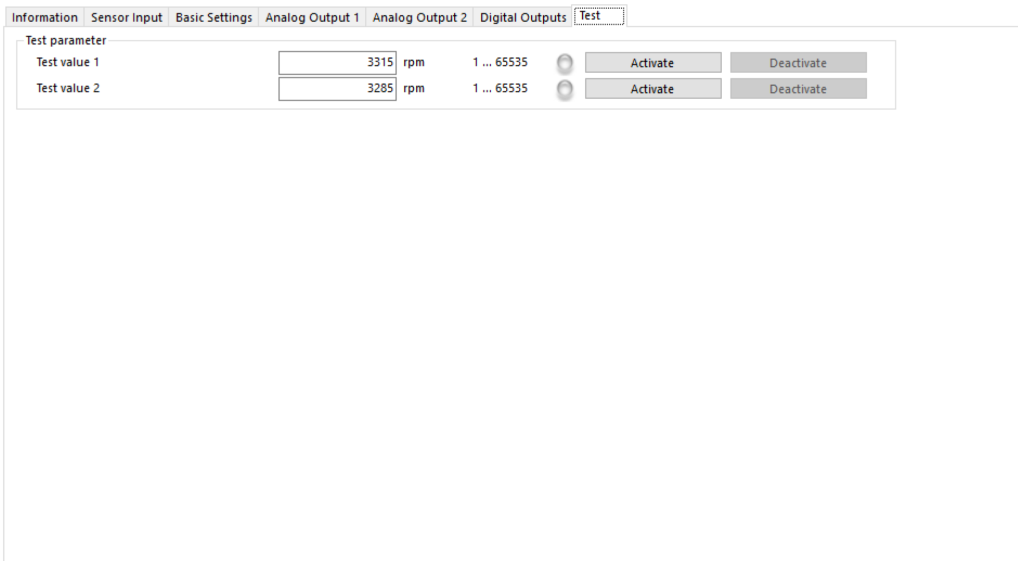
Example for function output configured for **>= Limit Value** and mode **Closed-circuit mode**:

The initial state of the function output shows a level of +24 V. When the measuring value exceeds the limit value, the condition is met and the function output switches to 0 V.

Test

Define and activate here the test values for testing the AMS 6300 SIS monitor. The test values must be sent to the monitor before use. See Test values for further information.

Figure 5-47: Test



Test value 1 ***and*** *Test value 2*

Enter here the two test values. Set, for example, **Test value 1** to trip limit +15 rpm and **Test value 2** to trip limit -15 rpm.

Activate ***and*** *Deactivate*

Click **Activate** or **Deactivate** beside the input fields of the test values to activate or deactivate the test value through the existing online connection. The LED beside the test value indicates the activated test value with a yellow light.

⚠ CAUTION

An activated test value replaces the measuring value in the AMS 6300 SIS. To avoid an unintentional trip during the ongoing operation, ensure that no more than one monitor has an activated **Test value** ≥ **Trip limit value** at any time. Before continuing the test with the next monitor, the test value of the currently tested monitor must be deactivated and the trip message reset. If another monitor detects a disturbance or an overspeed is detected during a test with **Test value** ≥ **Trip limit value** the machine trips.

Configuration data send and receive

6 Visualization

6.1 Display

After switching on the power supply or after plugging the monitor into a rack with a connected power supply, the display shows the text "A6370" and then for about 2 seconds the firmware version of the monitor such as:

V 2.00

After this, the display shows **START-UP** and then the speed value **RPM XXXXX**. If an error, for example, an analog error (message **ANALOG**) has been detected, the display indicates the speed value alternating with the error message.

Depending on the configured maximum speed, the speed value is displayed with one fractional digit.

- One fractional digit with **Maximum speed** <100 rpm.
- No fractional digit with **Maximum speed** ≥100 rpm
- Speeds ≥10000 rpm will always be displayed without fractional digit, independent from the configuration of parameter **Maximum speed**.

6.1.1 Error, warning, and status messages

See Table 6-1 for possible error, warning, and status messages and their meaning. These messages are displayed alternating with the current speed.

Table 6-1: Error, warning, and status messages

Message	Meaning
IDENTIFY	Is displayed when command **Identify** for the identification of the monitor in the rack was sent.
NOCALIB	A calibration error has occurred.
INTERROR	An internal error has occurred.
STARTUP	This message is displayed during startup of the monitor, after power was switched on. During this phase, all outputs are in the initial state.
DEFAULT	Indicates that the default configuration is loaded in the monitor.
OVERFLOW	A speed >65535 rpm is measured.
OVERTEMP	This error message shows that the monitor was switched off due to over temperature (120 minutes > 65°C or 1 minute > 70°C).
ANALOG	The monitor was switched off due to an analog error (see Analog comparison).
PULSE	The monitor was switched off due to a pulse error (see Pulse comparison). This error message is a total pulse error message. The monitor status message shows a detailed break down of this message.

Table 6-1: Error, warning, and status messages *(continued)*

Message	Meaning
SENSOR	Is shown when the sensor voltage at the input exceeds the configured sensor voltage limits. See Upper sensor voltage limit and Lower sensor voltage limit).
RELAY	This error message is displayed when the safety relay (Trip relay) is in the notsafe state at the end of the startup (see Remedy of faults) or when the periodic check of the safety relay has detected a failure.
GAP	This error message appears when the measured input voltage exceeds the configured gap limits. See Upper gap limit and Lower gap limit.

6.1.2 LEDs on the monitor front

There are eight LEDs which display the channel status, the trip status, and the states of the six function outputs (see Figure 6-1) on the monitor front of the AMS 6300 SIS.

Figure 6-1: LEDs on the monitor front

LED OK

This LED on the monitor front shows the states of the monitor supervision. During the normal, undisturbed operation this Channel OK LED must be green.

This indication shows the logical states of the channel supervision functions, the electrical state of the corresponding output result from the chosen operating principle **Open circuit mode** and **Closed circuit mode**. See System supervision functions for further information on the monitor supervision.

LED Trip

This red LED is switched on when the protection function has triggered. One condition for the trip function is, for example, when the measured speed has reached or exceeded the trip limit (tab **Digital Outputs**) or when a wrong rotational direction was detected.

LED Digital outputs 1-6

The six LEDs describe the logical states of the function outputs of this monitor.

This means, when an output was configured, for example, for a limit exceeding, the exceeding of this limit will be indicated with the relevant LED. The electrical state of this output (High or Low) is not shown with this LED.

The operating principle (**Open-circuit mode** or **Closed-circuit mode**) of the outputs can individually be set.

6.2 View Monitor-Status

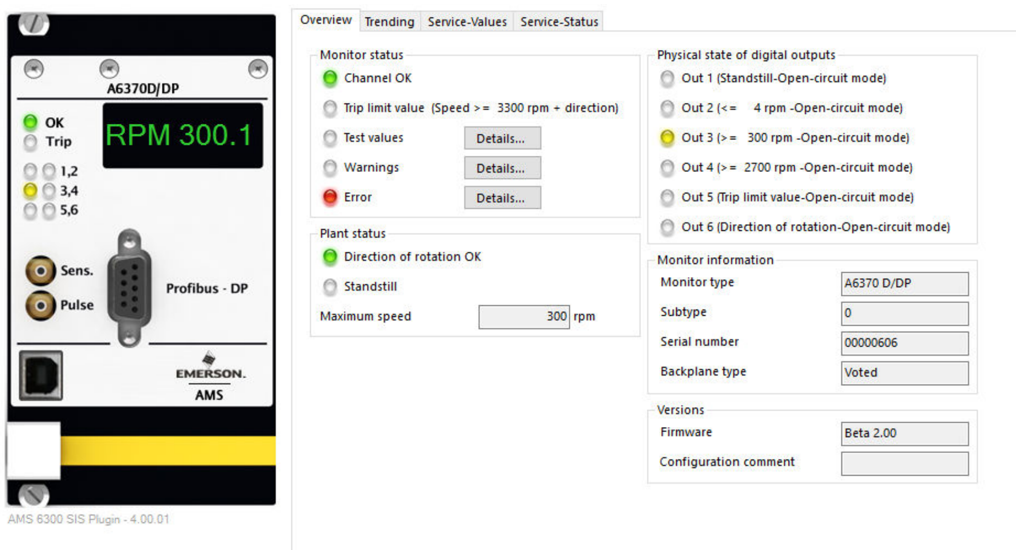
This status view requires an online connection between monitor and computer. Click the respective monitor in the rack overview to open the status view.

The online view shows the front of the module including the display with the measuring value and with the LEDs which are an exact copy of the LEDs on the front of the monitor. Beside the front view there are several tabs containing additional status information.

6.2.1 Overview

This tab contains serial number and firmware versions in addition to the status information. Status messages are realized with graphical LEDs. See Figure 6-2.

Figure 6-2: Overview



Group Monitor status

This part of the tab shows information on the monitor status.

Channel OK

A fault-free channel is indicated with a green LED. In case of a disturbance this LED is switched off. See Channel OK Channel supervision for further information on the channel supervision.

Trip limit value (>= xxxx rpm)

This LED shows the trip status of the monitor. The switching condition and the adjusted trip limit are shown in brackets (for example, speed >= 3300 rpm + direction). A monitor in the safe state (trip limit exceeded) is indicated with a red LED. If the trip condition is not met, the LED is switched off.

Test values

Active test values are indicated with a yellow LED. Click **Details** to open **Service-Status** to get further information on the test values.

Warnings

Applied warnings are indicated with an orange LED. Click **Details** to open **Service-Status** to get further information on the warnings.

Error

Applied errors are indicated with a red LED. Click **Details**to open **Service-Status** to get further information on the reason of the error.

Group Plant status

Direction of rotation OK

This LED indicates whether or not the recognized rotational direction corresponds to the configured preferred rotational direction. When the shaft turns in the correct direction, the LED is green. The inverted rotational direction effects the LED to be red.

Standstill

After the standstill time – defined on **Configuration** → **Basic Settings** → **Standstill detection** – has elapsed, the LED is on. If, after a standstill, a pulse is detected at the signal input, the standstill message is reset.

Maximum speed

In this field the maximum measured speed is indicated. Use command **Monitor** → **Reset speed peak** to reset this value to zero. A corresponding access authorization is required.

Group Physical state of digital outputs

This field shows the physical state of the six digital outputs. For each output the logical condition (for example: **Standstill**) and the operating principle **Open-circuit mode** or **Closed-circuit mode** are shown. An activated output is indicated with a yellow LED. Based on the chosen operating principle an output may be physically active (switched) even when the logical condition for this output is not met.

Group Monitor information

In these fields statistical values, the current temperature, and the maximum temperature measured with the internal temperature sensor are displayed.

Reboots (<24 h)

This counter increases when an internal fault is detected. If no further faults are detected within the next 24 hours, the counter is reset to 0. If altogether 5 faults are detected, the monitor is switched off.

Reboots

This counter increases after every monitor restart, initiated by the software.

With an existing online connection to the monitor, use command **Monitor → Reset start counter** to reset the counter **Reboots**. A corresponding access authorization is required.

Cold starts

This counter is increased after every power-on.

With an existing online connection to the monitor, use command **Monitor → Reset start counter** to reset the counter **Cold starts**. A corresponding access authorization is required.

Temperature

The current temperature, measured by the monitor internal temperature sensor, is displayed here.

Maximum temperature

The maximum temperature, measured by the internal temperature sensor, is displayed here .

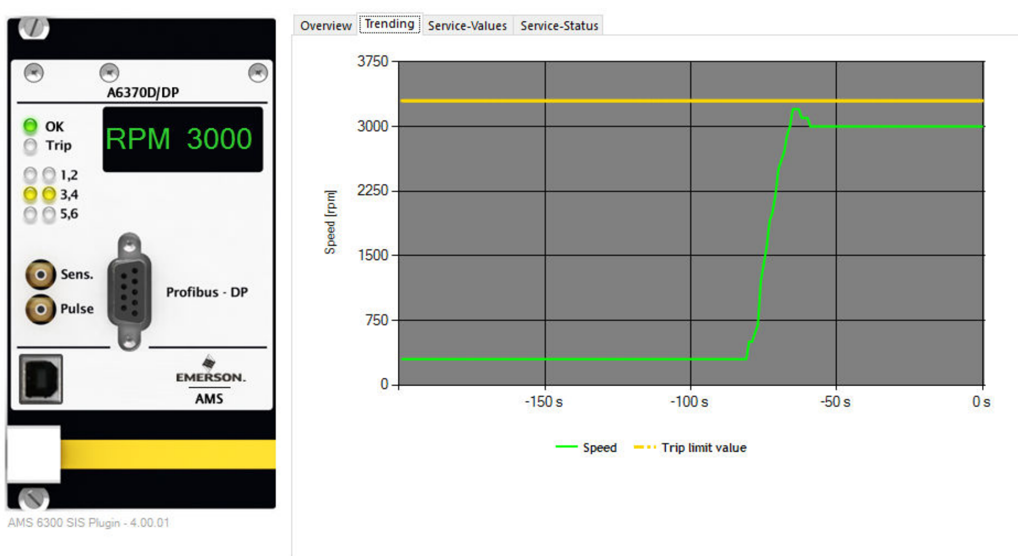
Group Versions

This menu shows firmware version and the Configuration comment, entered in input field **Configuration → Information → Configuration comment**.

6.2.2 Trending

This trend diagram displays the measured speed over the last 200 seconds in form of a green trend line. The yellow line indicates the configured trip limit. See Figure 6-3.

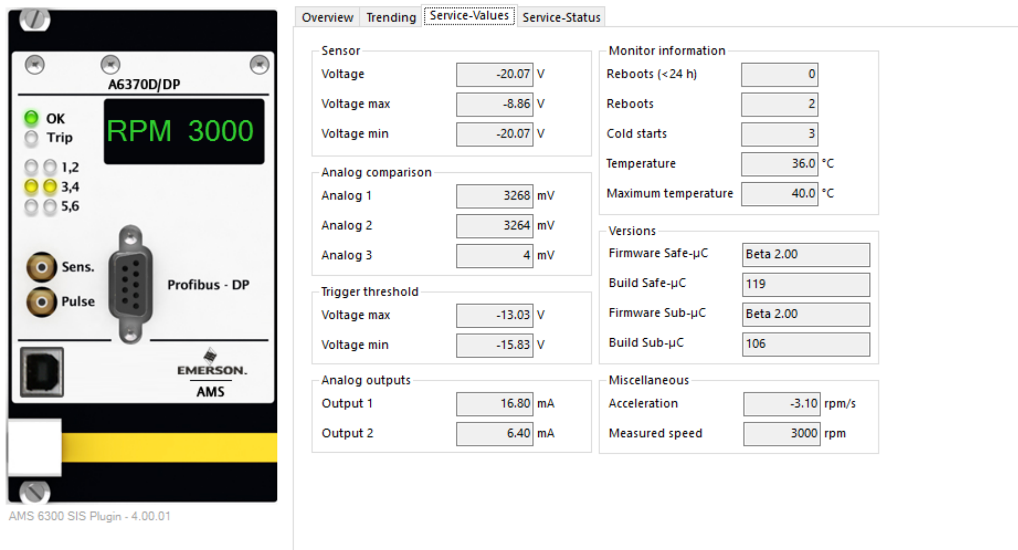
Figure 6-3: Trending



6.2.3 Service-Values

This tab contains several voltage levels, currents, and further parameters which may help, for example, to narrow down the cause in case of disturbances. See Figure 6-4.

Figure 6-4: Service-Values



Group Sensor

Voltage

This field displays the current measuring signal of the connected sensor.

Voltage max

This field displays the maximum signal level, measured within a measuring cycle.

Voltage min

This field displays the minimum signal level, measured within a measuring cycle.

Note
The trigger thresholds have to be within the maximum and minimum sensor voltage.

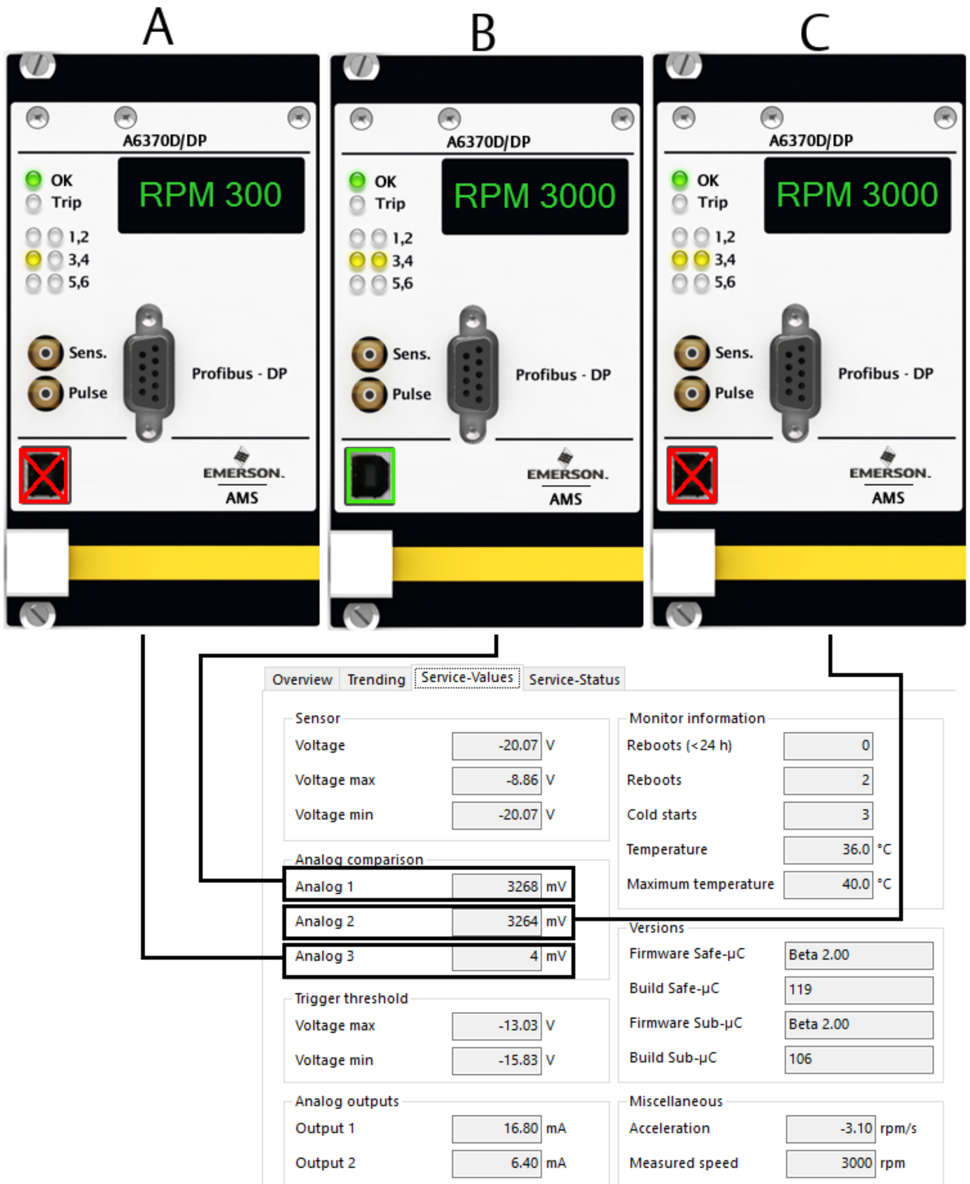
Group Analog comparison

The signal levels of the three monitors, used for the analog comparison are shown here. The voltage **Analog 1** is always the voltage of the monitor where the communication cable is connected to and where the communication with the computer is active. Starting at this monitor, counting goes on in clockwise direction. See Analog comparison for further information on the use of the analog comparison.

Example:

The configuration computer is connected with the middle one of the three monitors (monitor B) of the over speed protection system. Thus, voltage **Analog 1** is assigned to this monitor. Voltage **Analog 2** is assigned to the third monitor (Monitor C) and **Analog 3** to the first monitor (monitor A).

Figure 6-5: Example - monitor assignment to the analog voltages



A. Monitor A
B. Monitor B (connected to the configuration PC)
C. Monitor C

Group Trigger threshold

The trigger thresholds currently adjusted are displayed here. These values may vary depending on the distance between sensor and trigger wheel if function **Basic Settings** → **Offset tracking** has been activated.

Group Analog outputs

The set value of both current outputs is shown here — **Output 1** and **Output 2**. The indicated set value depends on the settings on tab **Analog Output 1** and **Analog Output 2**. The corresponding current value must appear at the respective current output.

Group Monitor information

In these fields statistical values, the current temperature, and the maximum temperature measured with the internal temperature sensor are displayed.

Reboots (<24 h)

This counter increases when an internal fault is detected. If no further faults are detected within the next 24 hours, the counter is reset to 0. If altogether 5 faults are detected, the monitor is switched off.

Reboots

This counter increases after every monitor restart, initiated by the software.

With an existing online connection to the monitor, use command **Monitor** → **Reset start counter** to reset the counter **Reboots**. A corresponding access authorization is required.

Cold starts

This counter is increased after every power-on.

With an existing online connection to the monitor, use command **Monitor** → **Reset start counter** to reset the counter **Cold starts**. A corresponding access authorization is required.

Temperature

The current temperature, measured by the monitor internal temperature sensor, is displayed here.

Maximum temperature

The maximum temperature, measured by the internal temperature sensor, is displayed here .

Group Versions

The firmware versions are shown here, detailed classified according to safe µC and sub µC.

Group Miscellaneous

Acceleration

The current acceleration value is shown here.

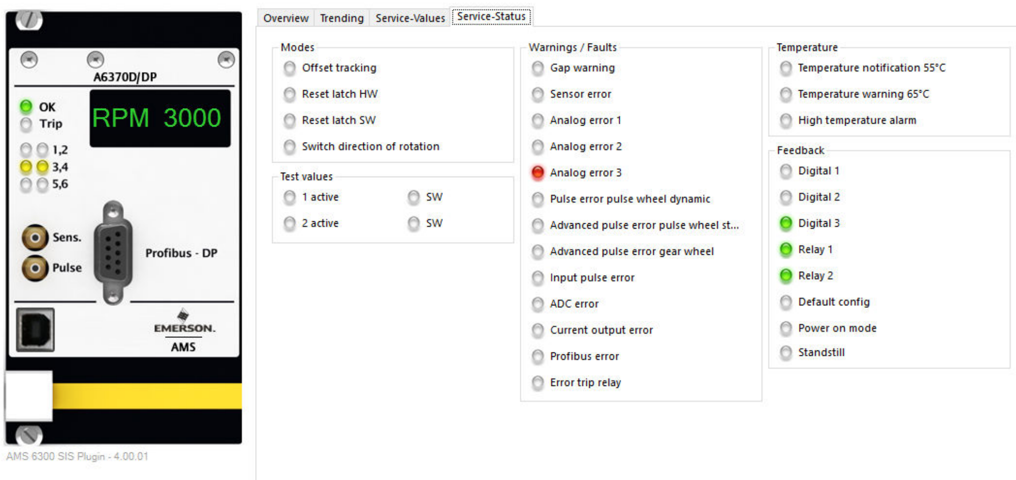
Measured speed

This field displays the unaffected speed value. An activated test value, for example, affects the measured speed values.

6.2.4 Service-Status

Servicestatus indicates warnings, fault functions, and feedbacks with graphical LEDs.

Figure 6-6: Service-Status



Group Modes

This graphical LEDs indicate the state of the functions **Offset tracking** (see Offset tracking) and **Switch direction of rotation** (see Sensor switch). The status whether the command **Reset Latch** is being carried out with the configuration software **Reset Latch SW** or through the hardware input **Reset Latch HW** is indicated.

Group Test values

An activated test value is indicated with a yellow LED. A test value activated by the command of the configuration software and not by the external input is indicated by LED **SW**.

Group Warnings / Faults

This group shows a list of messages. The meaning of the individual messages is described in Table 6-2. Warnings are indicated with yellow LEDs and faults with red LEDs.

Table 6-2: Meaning and possible reasons for fault functions

Warning / Fault	Meaning	Reason
Gap warning	The sensor voltage has exceeded the upper gap limit or has fallen below the lower gap limit.	Distance trigger wheel sensor has changed: • Radial clearance has risen. • Sensor holder has come loose.
Sensor error	Sensor voltage has exceeded sensor voltage limit. **Channel OK** is switched off.	• Distance trigger wheel – sensor too small. • Sensor cable broken.
Analog error 1	The monitor just being in communication with the computer has indicated an analog error. **Channel OK** is switched off.	• Sensor fault. • Trigger threshold does not suit to sensor signal. • Parameter **Maximum speed** different.
Analog error 2	The next monitor in clockwise direction indicates an analog error.	
Analog error 3	The second monitor in clockwise direction indicates an analog error.	
Pulse error pulse wheel dynamic	Pulse error at trigger wheel. **ChannelOK** is switched off.	Phase between signals has changed: • Trigger thresholds misadjusted. • Radial arrangement of sensors has changed (sensor holder has become loose). Missing signal pulses.
Advanced pulse error pulse wheel static	Same signal level on all three channels. **Channel OK** is switched off.	
Advanced pulse error gear wheel	Pulse error at gear wheel. **Channel OK** is switched off.	
Input pulse error	Missing pulses in TTL signal. **Channel OK** is switched off.	
ADC error	Error in analog - digital - converter. **Channel OK** is switched off.	Hardware fault.
Current output error	Current output error	Hardware fault.
Profibus error	Problem with PROFIBUS - communication	Hardware fault.
Error trip relays	Problem with trip relay detected. **Channel OK** is switched off.	• Error in configuration. • Hardware fault.

Group Temperature

In three steps (temperature notification 55°C, temperature warning 65°C, and high temperature alarm), the condition of the internal temperature supervision is indicated here. When reaching high temperature, **Channel OK** of the monitor is switched off.

Group Feedback

In this group the feedbacks of several functions are listed. Table 6-3 describes their meaning.

Table 6-3: Meaning of the feedbacks

<table>
<tr><th>Feedback</th><th>Meaning</th></tr>
<tr><td>Digital 1</td><td>The green flashing LED shows the change of the logical state (Low or High) of the TTL signal for the monitor just being in communication with the computer.</td></tr>
<tr><td>Digital 2</td><td>Logical state of the next monitor clockwise.</td></tr>
<tr><td>Digital 3</td><td>Logical state of the second monitor clockwise</td></tr>
<tr><td>Relay 1</td><td rowspan="2">Feedback of the trip relay.
The LED for each relay is green if the trip condition is not met. The contacts are closed.
The LEDs are switched off if the trip condition is met. The contacts are open.</td></tr>
<tr><td>Relay 2</td></tr>
<tr><td>Default config</td><td>If this LED is activated, the monitor is in the delivery state and still loaded with the default configuration.</td></tr>
<tr><td>Power on mode</td><td>After power-up and during the start phase the monitor runs into the START-UP phase. This is indicated with a yellow LED.</td></tr>
<tr><td>Standstill</td><td>After countdown of the standstill time defined with parameter Digital Outputs → Standstill this LED is switched on.</td></tr>
</table>

7 Functions and applications

Beside the AMS 6300 SIS function descriptions, this chapter also contains application descriptions and instructions for fault finding.

Related information

Technical support

7.1 Speed measurement

For the determination of the speed, the AMS 6300 SIS processes the sensor signal with the configured trigger thresholds to generate the 0 to +5 V TTL signal. Each recognized tooth corresponds to one pulse of the TTL signal. With the parameter **Trigger wheel, number of teeth** the information on the number of teeth is available. On the basis of this parameter and the time for the recognition of the number of pulses, the speed is calculated in [rpm].

The maximum speed to be measured with the AMS 6300 SIS is 65535 rpm. It is limited on the maximum input frequency of 20 kHz. The number of teeth of the trigger wheel has an influence on the signal frequency. Use the following formula to calculate the maximum speed ($Speed_{max}$) to be measured based on a certain number of teeth for the trigger wheel.

$Speed_{max}$ = (Input frequency * 60s) / n

Example with input frequency 20 kHz and n = 32 teeth:

$Speed_{max}$ = (20000 * 60s) / 32 = 37500 rpm

VR sensor

At VR sensors used for the speed measurement the signal amplitude and signal frequency of the sensors are process to a TTL signal. The lowest permissible signal amplitude is 1.0 V.

Related information

Technical support

7.2 Detection of rotational direction

The AMS 6300 SIS is provided with two modes for the detection of the rotational direction:

- Detection of rotational direction in safety function **Protection against wrong direction of rotation**.
- Detection of rotational direction at gear wheels (no safety function)

The detection of rotational direction is carried out at the start of the machine up to a signal frequency <166 Hz. At higher speeds (signal frequencies) the detected direction of rotation is frozen. For a trigger wheel with 32 teeth the signal frequency of 166 Hz corresponds to a speed of about 311 rpm.

The differences between and the requirements on these two measuring modes for the detection of rotational direction are described in Detection of rotational direction at gear wheels and Detection of rotational direction in safety function Protection against wrong direction of rotation.

Note
Detection of rotational direction is not possible when using VR sensors.

Related information

Technical support

7.2.1 Detection of rotational direction at gear wheels

The detection of rotational direction at gear wheels is no safety function of the AMS 6300 SIS. See Mechanical prerequisites for the required arrangement of the sensors at the gear wheel and the dimensions. The output of the rotational direction is made through the monitor status indication and through a function output with a corresponding configuration.

Prerequisite for the detection of rotational direction is that all three channels of the AMS 6300 SIS are in working order — the channel supervision indicates **Channel OK** (OK). If only one channel is not working, the detection of rotational direction at gear wheels does not work.

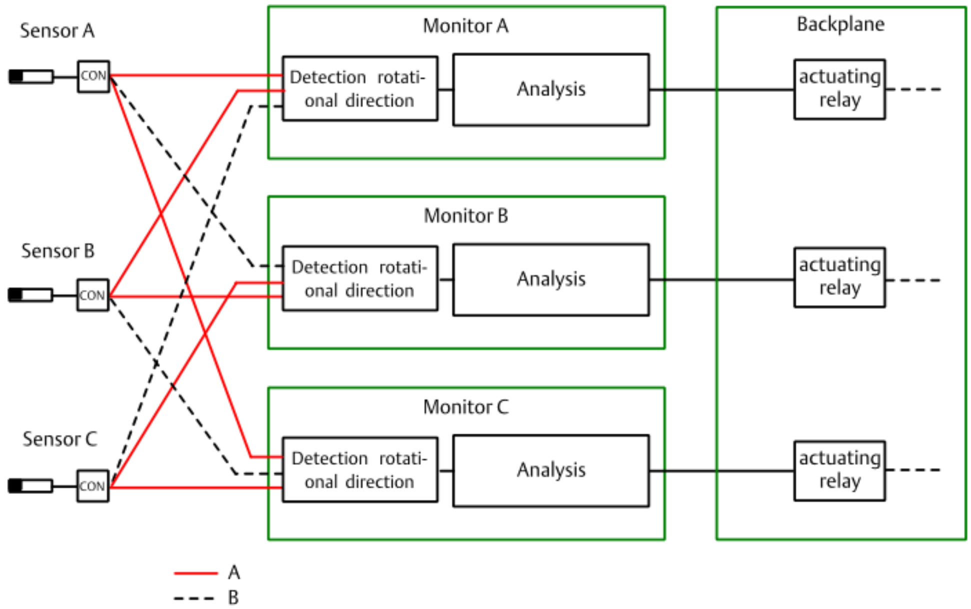
Related information

Technical support

7.2.2 Detection of rotational direction in safety function **Protection against wrong direction of rotation**

The AMS 6300 SIS detects the rotational direction by comparing the time shift between the pulses of two measuring channels. Figure 7-1 shows which channels are compared. Monitor A detects the rotational direction on the basis of its own signal and the signal of monitor B. Monitor B needs the signal of monitor C and monitor C needs the signal of monitor A. If the regular partner monitor for the measurement fails, the input signal of the third monitor is used for the measurement. Example for monitor A: If monitor B fails, monitor A will take the signal of monitor C for the detection of the rotational direction. This increases the availability for detecting the rotational direction.

Figure 7-1: Channel assignment for rotational direction



A. Safety
B. Availability

When the detected rotational direction is opposite to the normal rotational direction, the trip for the monitor is released. The output of the rotational direction is made through the monitor status indication and through a function output with a corresponding configuration. Configure the function outputs on tab **Digital Outputs**.

See Mechanical prerequisites for the required arrangement of the sensors at the trigger wheel and the dimensions of the trigger wheel.

Related information

Technical support

7.2.3 Definition of rotational direction

The rotational direction is defined by the signal sequence of the channels. The signal sequence is defined by the arrangement of the sensors at the trigger wheel during the installation of the system and the assignment to the monitors. See **Monitor-Status → Overview** for the indication of the detected rotational direction. Depending on sensor arrangement and rotational direction of the machine, the direction is indicated with either a green or a red LED.

If the indicated **Normal** rotational direction does not correspond to the actual nominal rotational direction of the shaft, invert this indication with parameter **Basic Settings → Preferred direction of rotation**. If a digital output is required, configure a function output with the function **Digital Outputs → Output Function → Direction of rotation**.

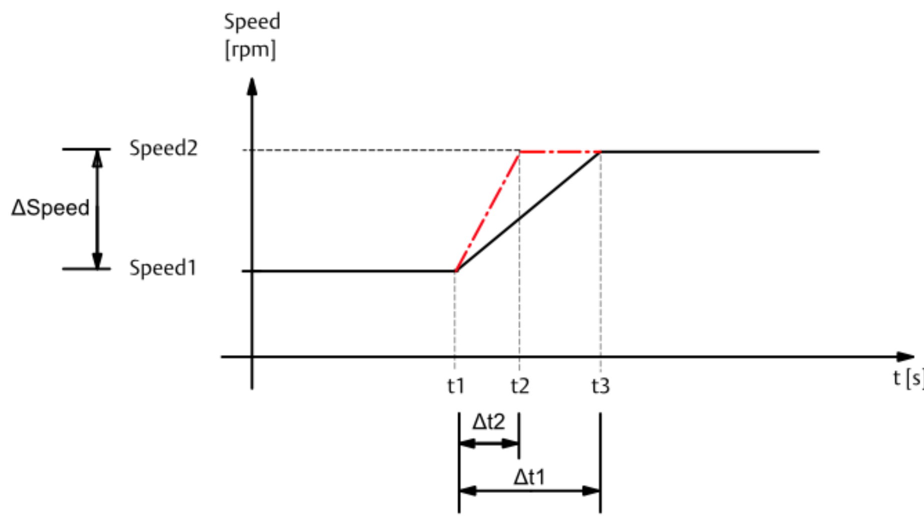
Related information

Technical support

7.3 Acceleration measurement

The AMS 6300 SIS measures the shaft acceleration in [rpm/s]. The measured acceleration can be checked on limit exceeding (see Group Parameter for output functions). Figure 7-2 below shows a diagram of the acceleration measurement. In this diagram **Speed1** changes to the new value **Speed2**. The red broken line shows the speed change (**ΔSpeed**) within a shorter time (**Δt2**), with a higher acceleration than the black solid line (**Δt1**). With the black speed course it takes some more time to reach **Speed2** – which means lower acceleration.

Figure 7-2: Diagram acceleration measurement



Related information

Technical support

7.4 Definition of the trigger thresholds

Manual definition of trigger thresholds and Automatic trigger threshold detection describe both possibilities for the definition of the trigger thresholds.

Note
Usage of VR sensors does not require a trigger threshold definition.

7.4.1 Manual definition of trigger thresholds

1. Use an oscilloscope to measure the input signal at low speed of the machine (turning gear operation) preferably at front socket **Sens.** of the monitor.

   Consider that the signal level at this socket corresponds to the absolute value of the original signal multiplied with factor 0.15. Divide the signal at this socket by 0.15 to get the original signal at the sensor output:

$U_{Signal} = U_{Sens.} / 0.15$
U_{Signal} = original signal, not attenuated
$U_{Sens.}$ = signal at front socket **Sens.**, measured voltage

2. Calculate the trigger thresholds with reference to the measured signal amplitude and the sensor adjustment levels.
   UTT = upper trigger threshold
   LTT = lower trigger threshold
   $U_{peak-peak}$ = peak to peak value of the signal amplitude
   U_{adjust} = sensor adjustment level over a tooth
   $UTT = (-3 * U_{peak-peak}) / (8) + U_{adjust}$
   $LTT = (-5 * U_{peak-peak}) / (8) + U_{adjust}$
   Example with $U_{peak\ peak} = 16$ V and $U_{adjust} = 5$ V:
   UTT = (-3 * 16 V) / (8) + (-5 V) = -11 V
   LTT = (-5 * 16 V) / (8) + (-5 V) = -15 V

Experience has shown that values 3/8 and 5/8 of the signal amplitude provide suitable trigger thresholds.

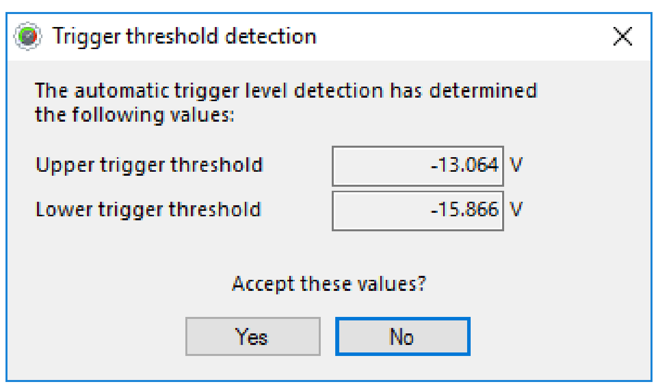
7.4.2 Automatic trigger threshold detection

The trigger thresholds for the measurement can also be defined automatically by the monitor. Prerequisite for this is an online connection to the monitor.

Before starting the automatic detection, ensure that the configuration with the correct sensor type has been sent to the monitor.

Start the automatic trigger threshold detection either with command **Monitor → Automatic trigger threshold adjustment** or through button **Sensor input → Trigger threshold detection**. Figure 7-3 shows the trigger threshold adjustment dialog.

Figure 7-3: Trigger threshold adjustment



With the automatic trigger threshold detection the optimum upper and lower trigger threshold is defined and displayed. Click **Yes** to confirm these values and to copy them to the configuration parameters. To activate the new trigger thresholds for the measurement, load the configuration parameters into the monitor.

7.5 System supervision functions

The AMS 6300 SIS is provided with several internal supervision functions:

- Analog comparison
- Pulse comparison
- Gap supervision
- Supervision of the measuring circuits

7.5.1 Analog comparison

The analog comparison function of the AMS 6300 SIS serves the internal comparison of the measured speed values. Each of the three monitors is provided with the speed information of the other two monitors in form of a voltage signal of 0 to 4096 mV (see Figure 7-4) through the backplane wiring and sends an error message in case of faults.

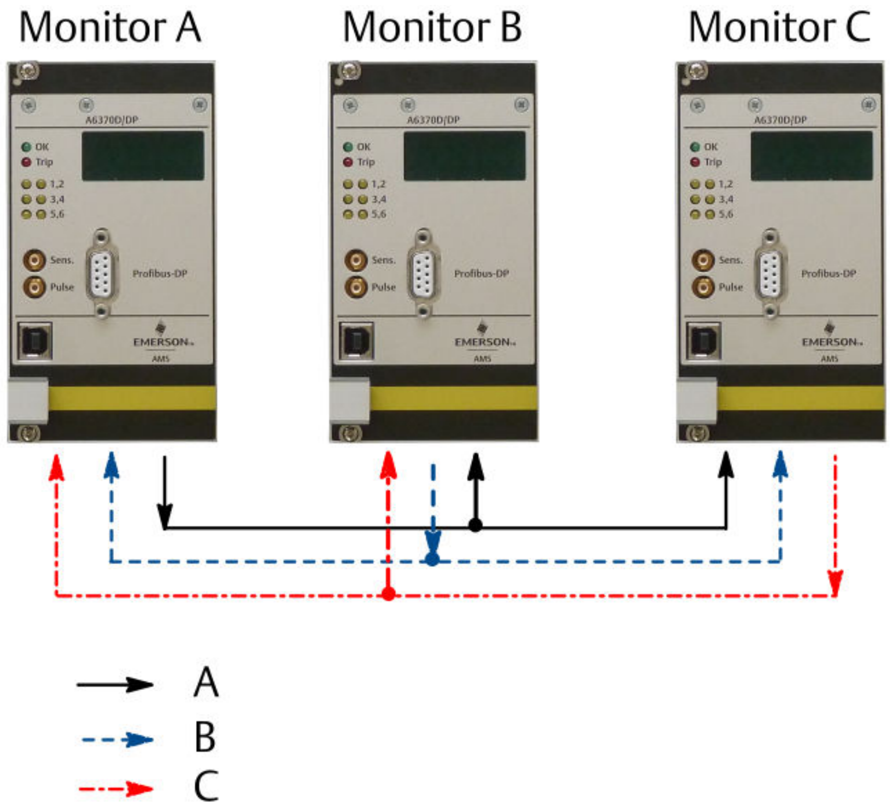
The analog voltage range 0 to 4096 mV is scaled at the configured maximum speed (**Basic Settings** → **Maximum speed**).

Note
The configuration of the maximum speed (**Basic Settings** → **Maximum speed**) must be identical for all three monitors. Otherwise, the analog comparison between the three monitors of the AMS 6300 SIS can not work properly.

A deviation in the analog comparison of more than 5% causes the switch off of **Channel OK** of the disturbed monitor.

Example: Monitor A compares its analog voltage with the analog voltage of monitor B and monitor C. Monitor A also compares the analog voltage of monitor B with the analog voltage of monitor C. If the analog voltage of monitor A deviates by more than 5% from the voltages of monitors B and C and if there is no deviation between the analog voltages of monitors B and C, monitor A indicates an analog error.

Figure 7-4: Comparison functions (Analog comparison / Pulse comparison)



A. *Analog voltage / Digital signal A*
B. *Analog voltage / Digital signal B*
C. *Analog voltage / Digital signal C*

7.5.2 Pulse comparison

The pulse comparison function of the AMS 6300 SIS serves the supervision of the sensor positions at the machine. To carry out this function, the sensors must be installed in a certain arrangement (that means with exactly defined mounting angles between each other). These mounting angles depend on design and structure of the used trigger wheel. Each of the three monitors gets the pulse signals of the other monitors as a digital signal through the backplane (see Figure 7-4). See Adjustment and arrangement of sensors at the machine for the arrangement and the installation of the sensors.

Note

The pulse comparison function is not possible with variable reluctance sensors (VR sensors).

The AMS 6300 SIS has four different modes to compare the pulse signals:

- Pulse comparison "Pulse wheel dynamic"
- Advanced pulse comparison "Pulse wheel static"
- Advanced pulse comparison "Gear wheel"

- Input pulse comparison

The advanced pulse comparison functions serve the better fault recognition. Activate the advanced pulse comparison functions with parameter **Basic Settings → Advanced pulse comparison**. See Visualization for the indication of pulse errors.

Pulse comparison "Pulse wheel dynamic"

The pulse comparison "Trigger wheel dynamic" is active when for parameter **Basic Settings → Safety function (Trip)** either the function **Direction of rotation** or **Speed + Direction** is set, **Eddy-Current** or **Hall** has been selected for parameter **Sensor type**, and when the input signal frequency is <166 Hz. The monitor evaluates the pulse sequence at the input channels for rotational direction and indicates the pulse error "Trigger wheel dynamic" when a fault is detected. One reason for a fault function may be, for example, an insufficient phase shift between the input signals due to incorrect sensor arrangements. This pulse comparison is not active when **Safety function (Trip) → Speed** has been selected and box **Sensor switch** is unchecked (deactivated).

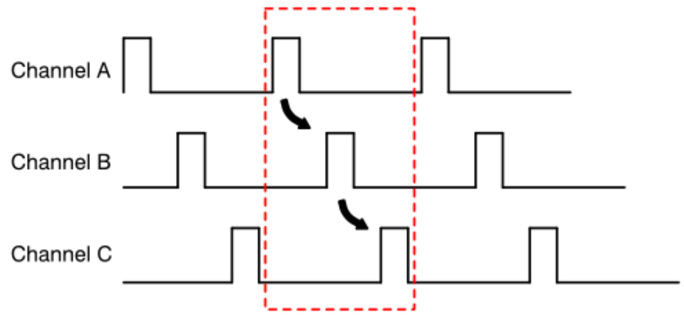
Advanced pulse comparison "Pulse wheel static"

To activate the advanced pulse comparison "Pulse wheel static“, place a checkmark in box **Basic Settings → Advanced pulse comparison** when **Pulse wheel** is configured for parameter **Basic Settings → Type of measurement (Pulse shape)**. The monitor indicates an advanced pulse error "Pulse wheel static" when all three sensor signals have the same logic level during standstill of the machine. This pulse camparison is only active when **Eddy-Current** or **Hall** has been selected for parameter **Sensor type**.

Advanced pulse comparison "Gear wheel"

To activate the advanced pulse comparison "Gear wheel", place a checkmark in the box **Basic Settings → Advanced pulse comparison** when **Gear wheel** is configured for parameter **Basic Settings → Type of measurement (Pulse shape)**. This pulse comparison is active at input signal frequency <166 Hz and when **Eddy-Current** or **Hall** has been selected for parameter **Sensor type**. The advanced pulse comparison "Gear wheel" evaluates the pulse sequence of all three monitors (see Figure 7-5). If one pulse is missing, the monitor indicates the advanced pulse error "Gear wheel".

Figure 7-5: Pulse sequence gear wheel



Input pulse comparison

The function "Input pulse comparison" compares the input pulses of all three monitors. If more than five pulses, compared with the other two monitors, are missing in the TTL signal , the monitor indicates the "Input pulse comparison" error. A reason for missing pulses could be incorrectly adjusted trigger thresholds.

The "Input pulse comparison" is always active, even if no detection of rotation direction is required.

7.5.3 Channel OK Channel supervision

The AMS 6300 SIS monitor continuously checks its readiness for operation. If a problem is detected with the connected sensor or in the monitor, **Channel OK** is switched off. The following errors or states affect the **Channel OK** status:

- Analog error (see Analog comparison)
- Pulse error (see Pulse comparison)
- Sensor error
  Is shown when the sensor voltage at the input is out of the OK range defined by the parameters **Upper sensor voltage limit** and **Lower sensor voltage limit** (see Group Measured quantities).
  At VR sensors: The channel supervision checks whether a VR sensor is connected or not. This supervision is active when a checkmark is placed in box **Sensor Input** → **Sensor monitoring** and machine standstill has been detected.
- Excess temperature
  When the temperature measured with the internal temperature sensor, exceeds +65°C for more than 120 minutes or +70°C for more than 1 minute.
- During startup of the monitor, after power is switched on.
- At internal hardware/software errors such as an ADC (analog-digital converter) error or a disturbed communication between the microcontroller for the safety functions and the sub-microcontroller.
- When the safety relay (trip relay) is in the not-safe state after the start-up.
- When the bootjumper is set to the wrong position (see Figure 3-2 for boot-jumper position).

When **Channel OK** is switched off, ...

- the Trip output is set to the safe state (relay deactivated).
- current outputs with output range 4 to 20 mA and activated current suppression are set to 0 mA.
- the digital output **Channel OK** is switched. The physical state of the output depends on the chosen operating principle (**Digital Outputs** → **Mode**).

The **Channel OK** state is indicated through LED **OK**, the digital output **Channel OK**, **Monitor status** indication, and through the optional PROFIBUS communication.

7.5.4 Standstill indication

The monitor has two types of standstill indication: the monitor internal indication and an external indication through a digital output. The standstill indication is also available through the optional PROFIBUS interface, if a digital output is configured for the standstill indication. The standstill time for both types of detection can be different.

Internal standstill indication

After the configured internal standstill time has elapsed, (**Basic Settings** → **Standstill detection**) the display and the online indication is set to 0 rpm. Active limits "> 0 rpm“ without latch are reset automatically after the expiration of the internal standstill time.

Example: Digital output 1 is configured with function ">= Limit value 4 rpm", after the machine is stopped, the display still shows an indication 15 rpm. The indicated speed is higher than the limit value, thus the condition for the digital output 1 is still met. The output is active. After the internal standstill time has expired, the speed is automatically set to 0 rpm. Now, the condition is not met any longer and the digital output 1 is automatically reset.

External standstill indication

After expiration of the configured standstill time (**Digital Outputs** → **Standstill**) a digital output, assigned to function **Standstill** is activated.

7.5.5 Test functions

The monitor has two types of test functions.

- Proof test
  When using the AMS 6300 SIS in a safety relevant system.
- Two configurable test values
  For testing configured alarm limits and the safety function **Speed**.

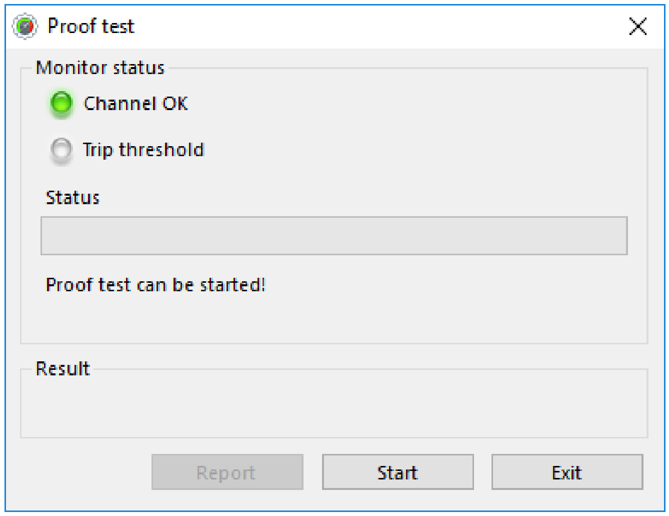
See Simulation of speed and rotational direction for external simulation of speeds.

Proof test

Within the scope of a SIL conform installation of the AMS 6300 SIS it may be necessary to carry out recurrent tests, called "Proof test". See the safety manual of the AMS 6300 SIS for information on the prerequisites for the test and a description how to proceed.

1. Click **Monitor** → **Proof test** to open the proof test dialog. See Figure 7-6.

Figure 7-6: Proof test - start



The test function checks whether all conditions for execution of the proof test are met. With a successful check, the button **Start** is enabled otherwise it is grayed out.

2. Click **Start** to start the proof test.
3. The result is displayed and the button **Report** is enabled. See Figure 7-7. Click **Report** to open the report. Print the report if necessary. Figure 7-8 shows a report of a successful proof test.

Figure 7-7: Proof test - result

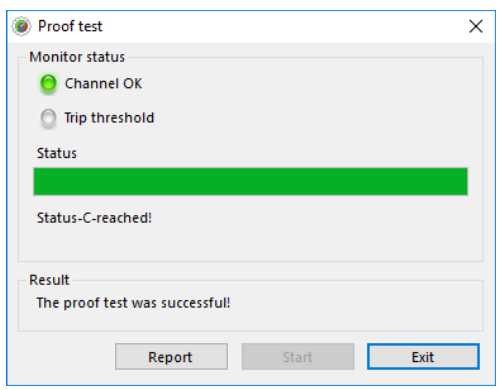
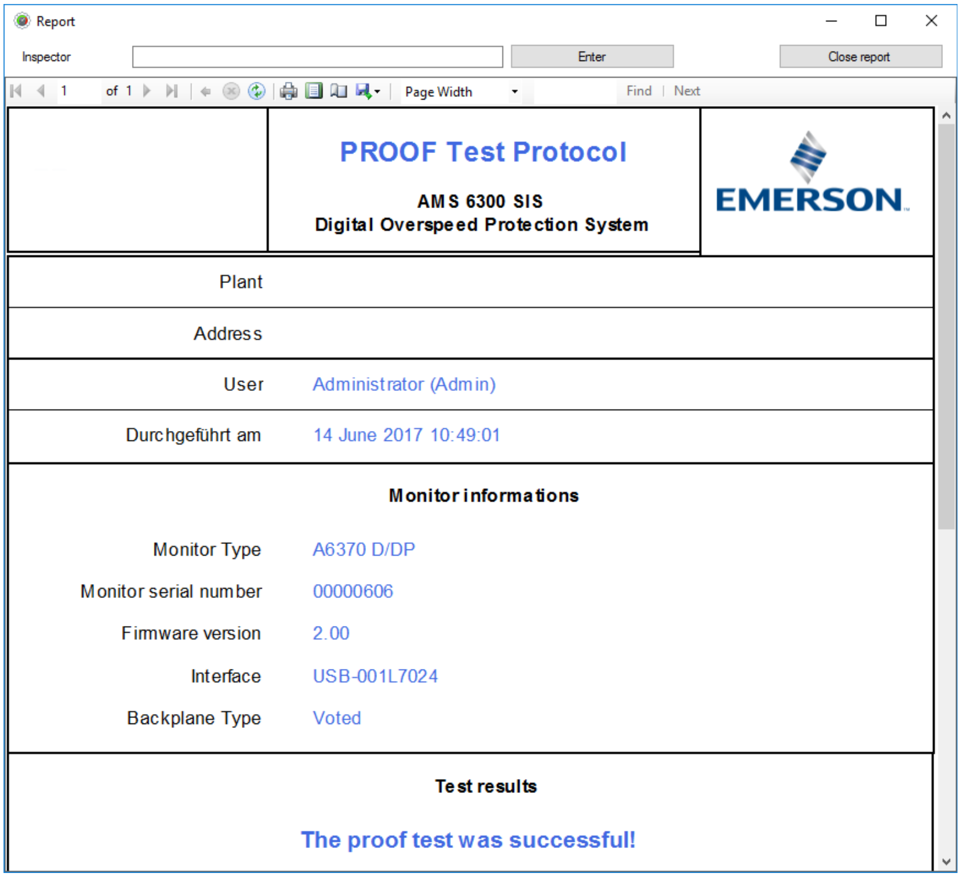


Figure 7-8: Report of a successful proof test



Test values

The test values serve the check of monitor functions, for example, during installation and commissioning when measuring signals from the machine are not yet available.

After the activation, the entered constant test value is checked instead of the measuring value when the measuring value is smaller than the test value. Only one test value can be activated at any one time. Since the test value is not supervised as long as it is smaller than the current measuring value, the overspeed protection remains active even while this test is carried out.

Activation of test values

⚠ CAUTION

The activated test values in the AMS 6300 SIS replace the measuring values.

To avoid an unintentional trip during the ongoing operation, ensure that at any one time not more than one monitor has activated **Test value** ≥ **Trip limit value**. Before starting to test the next monitor, deactivate the test value and reset the trip message of the previous monitor.

If another monitor detects a disturbance or an overspeed while the first monitor is being tested with **Test value** ≥ **Trip limit value**, the machine trips.

Note

If the test sets alarms with latch function, reset these latched alarms with the command **Rest latch** after the test to return to the normal measurement operation.

There are four ways to activate or deactivate the configured test values:

- By the digital inputs **Enable test** and **Test value 1** or **Test value 2**. See Digital inputs.
- By the optional PROFIBUS communication. See Profibus DP V0 (optional).
- With an existing connection to the monitor by tab **Test** of the configuration software. See Test.
- With an existing connection to the monitor by the dialog **Monitor** → **Enable test values**. See Monitor.

See Table 7-1 for the effect on outputs and indications of the monitor when a test value is activated.

Table 7-1: Influence of test values

Output / Indication	Measuring operation	Test operation (Test value active)
Sensor signal, socket "Sens."	Measuring signal	Measuring signal[1]
Indication monitor display	Measuring signal	Test value, when Test value > Measuring value
Online display speed	Measuring signal	Test value, when Test value > Measuring value
Current output Iout1	Measuring signal	Measuring signal
Current output Iout2	Measuring signal	Measuring signal
Safety output (Trip)	Supervision of measuring signal	Test value, when Test value > Measuring value
Output 1 to Output 6	Supervision of measuring signal	Test value, when Test value > Measuring value
Pulse output, socket „Pulse“	Measuring signal	Measuring signal
Pulse outputs X, Y, and Z	Measuring signal	Measuring signal
Profibus parameter "Speed" (optional)	Measuring signal	Measuring signal

1 *No signal if a VR sensor is connected.*

Simulation of speed and rotational direction

The function of the AMS 6300 SIS can also be checked by the simulation of the sensor signals. For this, you need a function generator, suitable to generate signal levels according to the requirements of the sensor input. Ideally, this signal with DC portion and amplitude should correspond exactly to the real sensor signal to avoid changes in the parameter setting regarding sensor input (trigger thresholds, gap limits). If the rotational direction is to be tested, use a three-channel function generator with a phase shift of 120° between the channels. Depending on the configured sensor type see Figure 7-9, Figure 7-10, or Figure 7-11 for an example how to connect a function generator to a monitor of the protection system. Change the signal frequency to change the speed. The frequency to be adjusted at the function generator depends on the number of teeth of the trigger wheel. Use the following formula to calculate the required signal frequency [Hz] for a desired speed [rpm] depending on a certain number of teeth [n].

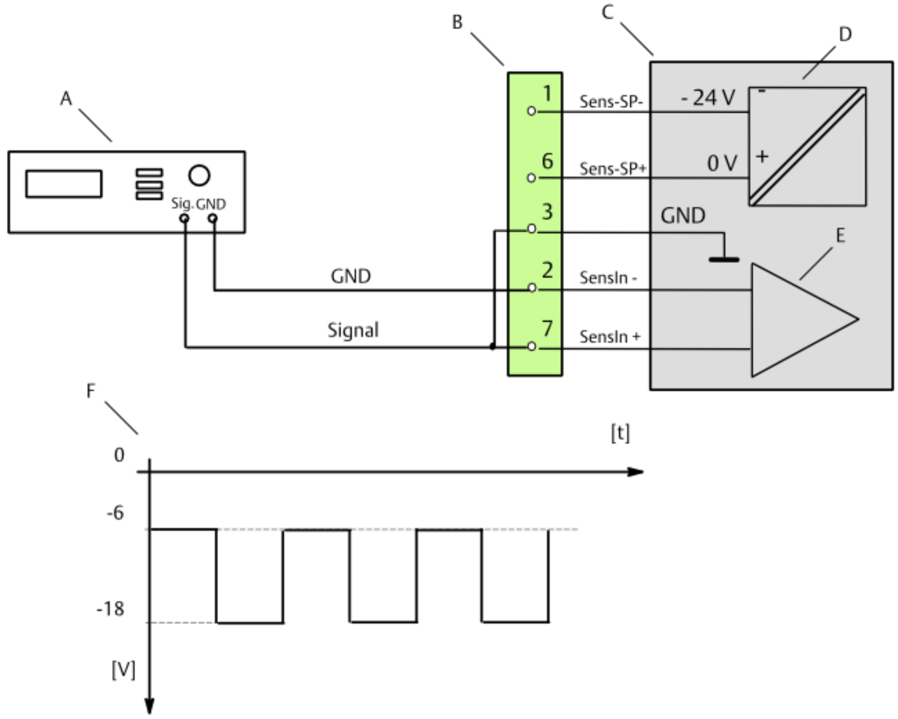
Frequency = (Speed * n) / 60s

Example with speed = 3000 rpm and a trigger wheel with 32 teeth:

$\text{Frequency}_{\text{Generator}}$ = (3000 rpm * 32) / 60s = 1600 Hz

To simulate a speed of 3000 rpm, generate a signal with a frequency of 1600 Hz.

Figure 7-9: Function generator - example eddy current sensor signal

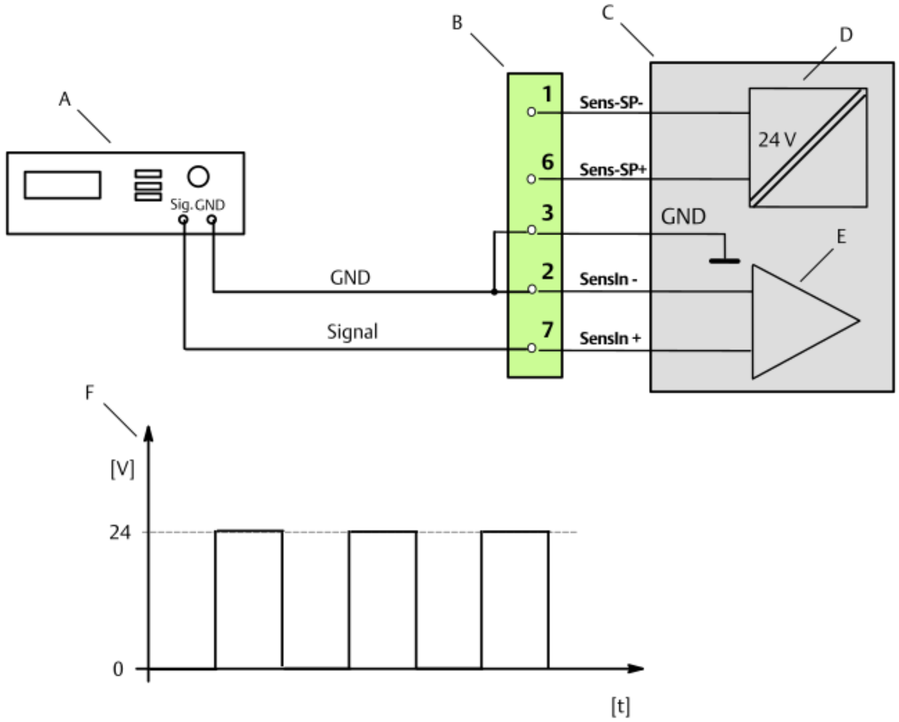


A. Function generator
B. 9-pole Sub-D terminal block monitor A, B, and C (analog signals)
C. AMS 6300 SIS
D. Sensor supply
E. Signal input
F. Function generator signal

Note

To avoid disturbances of the monitor, ensure that the output of the function generator is floating — the signal ground must be isolated from ground.

Figure 7-10: Function generator - example Hall effect sensor signal

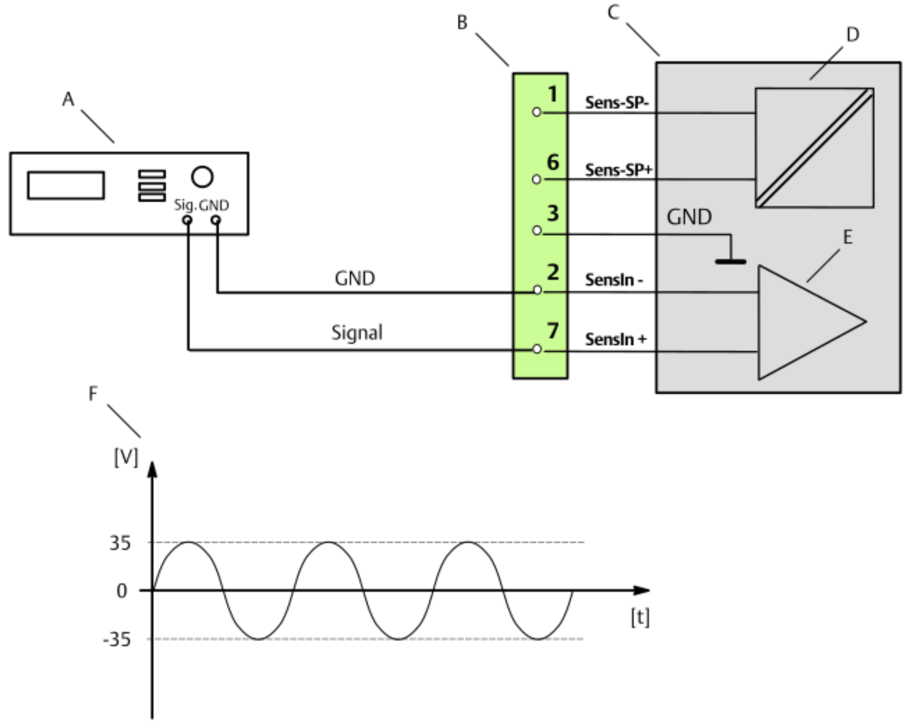


A. *Function generator*
B. *9-pole Sub-D terminal block monitor A, B, and C (analog signals)*
C. *AMS 6300 SIS*
D. *Sensor supply*
E. *Signal input*
F. *Function generator signal*

Note

To avoid disturbances of the monitor, ensure that the output of the function generator is floating — the signal ground must be isolated from ground.

Figure 7-11: Function generator - example VR sensor signal



A. *Function generator*
B. *9-pole Sub-D terminal block monitor A, B, and C (analog signals)*
C. *AMS 6300 SIS*
D. *Sensor supply*
E. *Signal input*
F. *Function generator signal*

Note
To avoid disturbances of the monitor, ensure that the output of the function generator is floating — the signal ground must be isolated from ground.

7.5.6 Remedy of faults

This section is intended to provide some support to solve the problem in case of disturbances or fault functions of the system. See Group Warnings / Faults for a list of error messages with possible reasons. Before contacting a service field office, click **Monitor** → **Service report** → **Create** to generate a report which contains monitor status and monitor configuration. Pass it on to an Emerson service center to simplify fault finding. For service center addresses see the introduction of this manual.

One or more monitors do not show Channel OK (OK)

The system supervision checks continuously all functions of the system. The reason for **Channel OK** is switched off could be in the measuring environment or on the monitor.

For support see **Monitor-Status** view for status messages and measuring values (View Monitor-Status).

Analog comparison indicates Analog error

The indications **Analog 1**, **Analog 2**, and **Analog 3** on tab **MonitorStatus → ServiceValues** show the current analog voltages of the three monitors.

After a correct installation of the sensors and a correct configuration of the monitors (identical speed value for parameter **Basic Settings → Maximum speed**), all three monitors display an almost identical analog voltage. If the voltages differ by more than 5% of the maximum value, the system supervision indicates the analog error and switch off **Channel OK** (see Analog comparison).

If the configuration of all three monitors regarding the parameter **Basic Settings → Maximum speed** is identical, the reason for the fault is probably in the measuring chain sector. The following faults cause an analog error:

- Faults at the eddy current measuring chains such as cable break, converter defects, and/or sensor defects.
- Mechanical changes of the sensor environment. Examples:
  Distance between sensor and trigger wheel has changed because of a loosen sensor holder.
  Increased radial clearance.
  Movement of the trigger wheel out of the sensor measuring range due to an axial shift of the trigger wheel. See next item (Trigger thresholds).
- The trigger thresholds does not fit to the input signal. Error symptom: The sensor signal can be measured at socket **Sens.** but there is no TTL signal at socket **Pulse**.

Pulse comparison indicates pulse error

The indications **Digital 1**, **Digital 2**, and **Digital 3** on tab **Monitor-Status → Service-Status** show the current states of the three sensors.

See Pulse comparison for the description of the four different modes of comparing the pulse signals. If one or more of these pulse comparison functions detects a fault, the system supervision indicates a corresponding pulse error and switches off **Channel OK**.

Depending on the pulse comparison function that indicates the error, remedial measures can be taken by correcting the sensor position, replacing a sensor, readjusting trigger thresholds, or by deactivating the advanced pulse comparison (**Basic Settings → Advanced pulse comparison**).

Instable measurements, fluctuating measuring values

Instable and fluctuating measuring values indicate fault functions of the measuring chain or incorrectly adjusted trigger thresholds.

- When using CON 041 signal converters, check, whether the sensors are connected correctly and that the polarity of signal and GND wire are not mixed up. In case of exchanged connections, when the cable shield of the coaxial sensor cable is connected to the “hot input" of the converter, the output shows strongly fluctuating values – especially when touching the sensor cable.

- Check whether the ground references of the input circuits are available and connected correctly. Since the measuring inputs of the AMS 6300 SIS are symmetrical and floating, the missing reference may result into instable and fluctuating measurements (see Sensor connection).
- Check the cable shielding. The cable shields must be connected according to the local shielding and grounding concepts. Support on this is given by the installation information of this manual.
- Another possible reason for a fault function is the trigger level adjustment. A signal level too low for the adjusted trigger thresholds causes dropouts in the measurements and as a consequence instable indications of measuring values. See **Monitor Status** to check the setting of the trigger thresholds. These thresholds must be clearly within the range defined by **Service-Values** → **Sensor Volatges Max** and **Service-Values** → **Sensor Volatges Min** (see Group Sensor).

Display shows RELAY

The state of the normally open contacts of a relay does not correspond to the state expected by the monitor.

Check, whether the correct backplane type (**Not-Voted** for A6371/10 or **Voted** for A6371/00) was set for parameter **Basic Settings** → **Backplane type**. With a correctly adjusted backplane type, the error message should be reset after a restart of the monitor. Restart the monitor by pulling the monitor from the rack and plugging it into the rack again. If the error message does not disappear, a relay could possibly be defect.

7.5.7 Replace a monitor

Follow the steps listed below if a monitor needs to be replaced, for example, due to a defect.

⚠ CAUTION

Any work at the overspeed protection system may impair machine protection.

Procedure

1. Save the monitor configuration.
   a) Connect the monitor through the USB interface to a laptop or PC.
   b) Start AMS 6300 Configuration. If the monitor is switched on, the software automatically connects to the monitor, opens the status view, and receives the configuration.
   c) Log in (**User** → **Login**).
   d) Note down bus address and baud rate (**Monitor** → **Set communication parameter**). The bus address is also used for the optional PROFIBUS communication.
   e) Click **Configuration** to open the configuration of the monitor.
   f) Save the configuration. Go to **File** → **Save monitor as**.

Do not close AMS 6300 Configuration.

2. Where appropriate, unplug the PROFIBUS cable.
3. Unscrew the mounting screws, unplug the configuration cable and remove the monitor from the slot.
4. Set the jumper for the RS 485 interface of the new monitor in accordance to the jumper settings of the old monitor.
5. Move the new monitor into the slot and press it firmly but gently into the connector. Fasten the screws at the front plate to secure the monitor in the slot.
6. Load the configuration into the new monitor.
   a) Connect the monitor through the USB interface to the PC / Laptop.
   b) If the monitor is switched on, the software automatically connects to the monitor.
   c) At a new monitor without any configuration the dialog for initialization of new monitors automatically opens. If the dialog does not open automatically, click **Monitor** → **Configuration** → **Initialize**.
   d) Select **with the configuration of another monitor**, the related list field is enabled. Select the corresponding configuration from the list. Alternatively, select **with a saved configuration** for loading a saved configuration file. Click **OK** to confirm and close the dialog.
   e) Click  or **Monitor** → **Configuration** → **Send** to send the configuration into the new monitor.
7. Enter bus address and baud rate according to your notes (**Monitor** → **Set communication parameter**).
8. Remove the interface cable after successful configuration and entering of bus address and baud rate.

   After changing the address for the PROFIBUS communication, power off and power on the monitor again to enable the address change. This can be done, for example, by pulling out and plugging in of the monitor.
9. Where appropriate, reconnect the PROFIBUS cable.

Postrequisites

If, because of a defect, there is no possibility to read out the configuration from the monitor, load either the configuration from an available file, from another monitor, or create a new configuration (see Configuration, **Initialize**).

8 Technical data

Only specifications with indicated tolerances or limit values are binding. Data without tolerances or without error limits are informative data and not guaranteed. Technical modifications, especially of the software, are subject to changes without notice. If not specified otherwise, all data are referred to an environmental temperature of 20°C.

8.1 Signal input and signal conditioning

Sensor input - Eddy current measuring chain and Hall effect sensor	
Input voltage range	0 to 26 V (+/-)
Limit range	±48 V
Input resistance	Typically 100 kΩ
Input frequency range	0 to 20 kHz 1 to 50% pulse with ratio (symmetry) Requirement: (InputFrequency*100)/(Symmetry*2) ≤ 30 kHz
Sensor type	Eddy current measuring chains such as PR 6423 with converter CON 011
	Hall effect sensors such as PR 9376
Other features	1 Signal input per monitor protected against polarity reversal

Sensor input - Variable reluctance sensor	
Input voltage range	Minimum: 1.0 V peak to peak Maximum: 25.0 V AC (approximately 70.7 V peak to peak) Input voltage internally limited.
Input resistance	Typically 18 kΩ
Input frequency range	Up to 20 kHz 1 to 50% pulse with ratio (symmetry) Requirement: (InputFrequency*100)/(Symmetry*2) ≤ 30 kHz
Channel Ok supervision	Channel not OK > 20 kΩ
Other features	1 Signal input per monitor

8.2 Analog outputs

Sensor signal output SMB socket Sens.
Mini-SMB socket on the monitor front, short circuit proof[1]

Sensor signal output SMB socket Sens.	
Permissible voltage range	0 to 3.9 V Signal: Absolute value of sensor input signal multiplied with factor 0.15 ±3%, reference system ground
Output Impedance	Typically 10 kΩ

1 *No output signal if a VR sensor is connected.*

Current outputs	
Two outputs per monitor, electrically isolated and with common ground	
Maximum output current	20 mA
Maximum burden	500 Ω
Accuracy	Measuring error ≤1% from measuring range
Adjustable ranges	0/4 to 20 mA, 20 to 4/0 mA
Life Zero mode	Selectable during configuration for the 4 to 20 mA or 20 to 4 mA mode. In case of system errors the output is set to 0 mA (current suppression).

8.3 Pulse outputs

TTL output	
MiniSMB socket on the monitor front, short circuit proof	
Voltage level	0 to 5 V (TTL signal)
Frequency range	0 to 20 kHz
Output impedance	Typically 10 kΩ

Pulse outputs	
The processed input pulses are output by an open-collector optocoupler output. The pulse outputs are electrically isolated and current limited.	
Number of outputs	3 per monitor
Maximum voltage	31.2 V
Maximum current	16 mA at 24 V
Frequency range	0 to 20 kHz
Signal level	Low: <3 V High: switching voltage Vcc -4V

8.4 Digital inputs

Binary inputs
Electrically isolated with common ground for all binary inputs.

Binary inputs	
Number	4 (Test value 1, Test value 2, Enable Test value, Reset Latch)
Signal level "Low"	0 to 5 V
Signal level "High"	13 V to 31.2 V
Input resistance	Typically 6.8 kΩ

8.5 Function outputs and Channel OK output

Binary outputs	
Electrically isolated and short circuit proof	
Number of outputs	7 (Out 1 to Out 6, Channel Ok (OK))
Signal level "Low"	< 100 mV
Signal level "High"	"System supply voltage" minus 2 V
Maximum current	25 mA
Function and limit value setting	Determined during configuration
Switchover open/ closed circuit mode	Freely configurable for each of the function outputs
Visualization of function outputs	With yellow LEDs on the front plate for each output Out 1 to Out 6
Visualization Channel Ok output	With a green LED on the front plate

8.6 Relay outputs

Relay outputs	
Contact load	Relay outputs Out2, Out3 & Channel OK: 48 V AC, maximum 4 A 30 V DC, maximum 4 A Trip Relay: AC1: 48 V / maximum 4 A AC15: 48 V / maximum 3 A DC1: 24 V / maximum 4 A DC13: 24 V / maximum 4 A / 0.1 Hz
Backplane A6371/00 Trip Voted	2 Relay outputs for Trip in 2oo3 Logic 1 Relay output Out 2 in 2oo3 Logic 1 Relay output Out 3 in 2oo3 Logic 1 Relay output Channel Ok in 1oo3 Logic
Backplane A6371/10 Trip Not Voted	3 Relay outputs for Trip (one per channel) 1 Relay output Out 2 in 2oo3 Logic 1 Relay output Out 3 in 2oo3 Logic

8.7 Communication interfaces

USB 2.0 Interface	
Configuration interface on the monitor front plate	
Socket	Type B

RS 485 Interface	
Bus interface for the communication with external devices	
Maximum number of devices	32
Baud rate	38400, 57600, or 115200 Baud

Profibus DP-V0 interface	
Optional interface for the communication with external systems (only monitors A6370D/DP), 9-pole Sub-D socket on front plate.	
Maximum number of devices	31
Data transfer rate	up to 12 Mbit/s

8.8 Power supply

System supply voltage	
Two redundant supply inputs with common ground, decoupled by diodes. Suitable for supply voltages from SELV/PELV power supplies.	
Nominal value	24 V
Range	+19 V to + 31.2 V
Maximum power consumption	30 W

Sensor supply	
One sensor supply per monitor, short circuit proof, and electrically isolated.	
Voltage level	±24.5 V ±1.5 V
Maximum current	35 mA

8.9 Tolerances and Response times

Tolerances	
Accuracy of the speed measurement	Maximum measuring error ±0.03% from measuring range

Response time	
Speed measurement	< Measuring time + 8 ms

Response time	
Detection of rotational direction	< 3 * Period of input signal + 8 ms
Typical reaction time	Mode of measurement **1x per rotation**: 35 ms at 3000 min^{-1} Mode of measurement **Automatic**: 12.5 ms at 3000 min^{-1}

8.10 Environmental conditions and mechanical design

Environmental conditions	
Temperature range without enforced cooling	-20 to +55°C
Temperature range with enforced cooling	-20 to +65°C
Temperature storage and transport	-40 to + 70°C
Humidity	5 to 95% non-condensing
Vibration	0.15 mm (58 - 62 Hz) 20 m/s^2 (up to 150 Hz)
Shock	100 m/s^2, 6 ms
Protection class	IP 20 for installation according to the operating manual
EMC	According to IEC 61326-1, IEC 61326-3-1 Unwanted emission according to DIN EN550011 class A
Operating altitude	5000 m 2000 m when installed according to CSA approval
Permissible pollution level	Category 2 (according to IEC 61010)
Environmental area	Indoor use only

Weight	
Backplane A6371/00 and A6371/10	490 g (without rack A6352)
Monitor A6370 D	250 g
Monitor A6370 D/DP	275 g

Dimensions	
Monitor A6370 D and A6370 D/DP	Width: 14 HP (approximately 71 mm) Height: 3 RU (approximately 128 mm) Printed board: 100 x 160 mm Connector: F48
Backplane A6371/00	W 211 mm x H 130 mm x D 43 mm

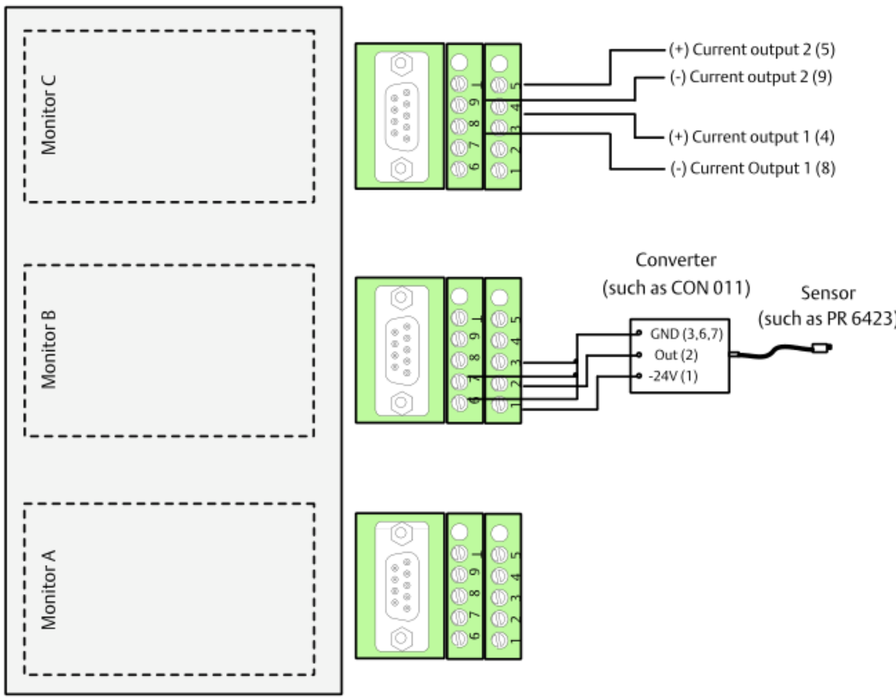
Dimensions	
Backplane A6371/10	W 211 mm x H 130 mm x D 58 mm
Board coating	Airborne contaminants resistance ISA-S71.04-1985 airborne contaminants class G3, Conformal Coating
	Material: HumiSeal® 1B31 EPA According to IPC-CC-830B and IPC-A 610
SubD Interface A6380	W 34.7 mm x H 65.5 mm x D 45.1 mm
SubD Interface A6381	W 57.4 mm x H 69 mm x D 62 mm
19“ Rack A6352	W 438.6 mm x H 132.5 mm x D 238.5 mm

Terminals SubD Interface A6380, A6381 and Backplane A6371/00, A6371/10	
Terminal cross sections for cable connections	Rigid cable: maximum 4 mm^2 Flexible cable: minimum 0.2 mm^2 Flexible cable: maximum 2.5 mm^2 AWG: minimum 24 AWG: maximum 12
Stripped length of wire	8 mm

9 Diagrams and certificates

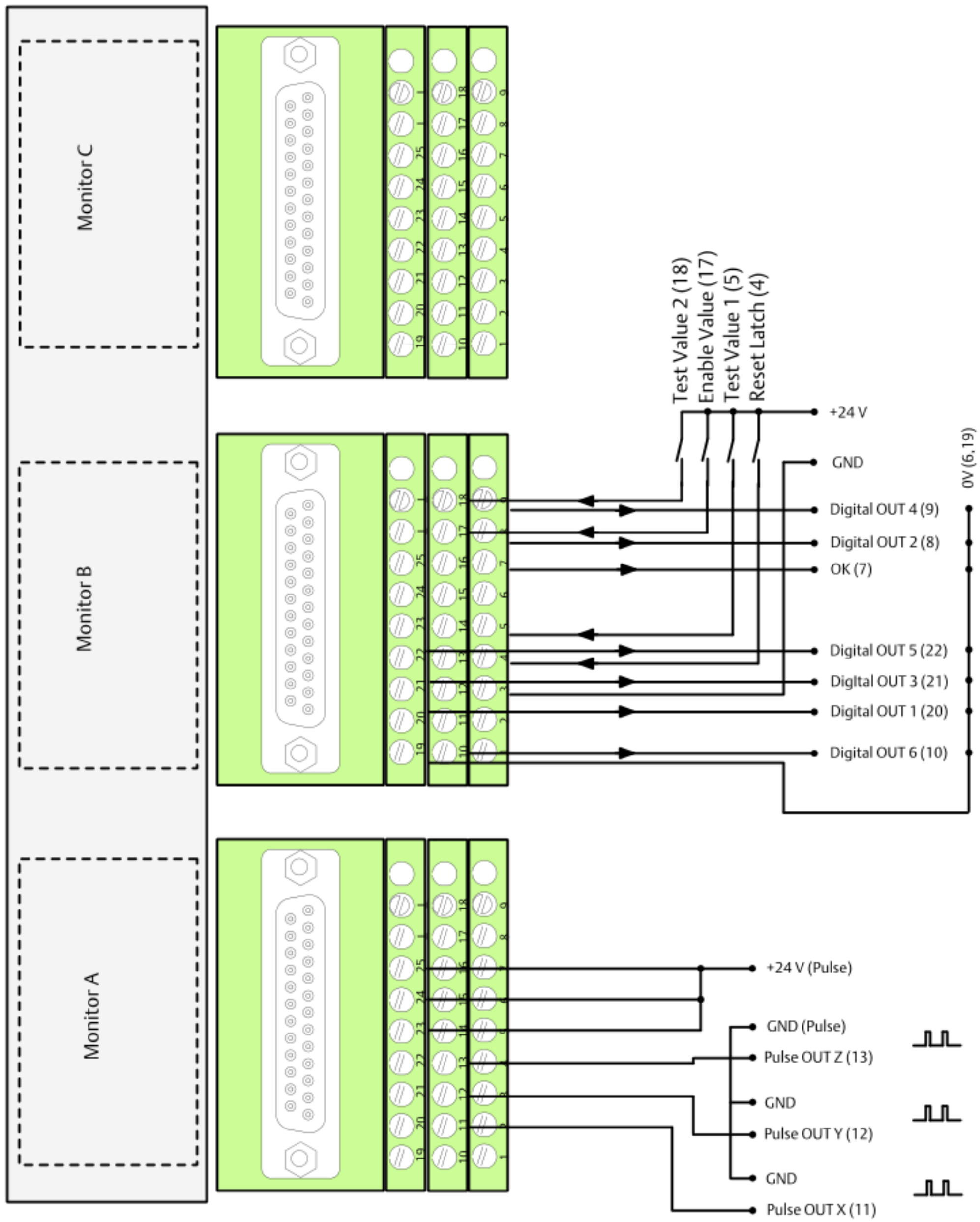
9.1 Connection diagrams

Figure 9-1: Connection diagram analog signals



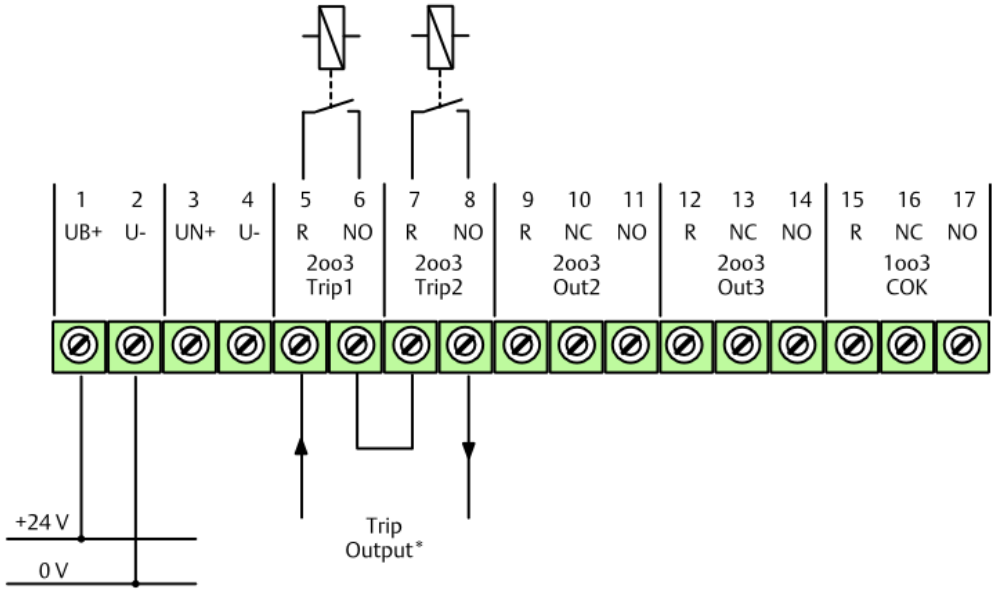
The connection of the analog inputs and outputs is identical for each monitor. Thus, only the input and output connection for one terminal is shown. For detailed sensor connection see Figure 9-5, Figure 9-6, and Figure 9-7.

Figure 9-2: Connection diagram digital signals



The connection of the digital inputs and outputs is identical for each monitor. Thus, only the input and output connection for one terminal is shown.

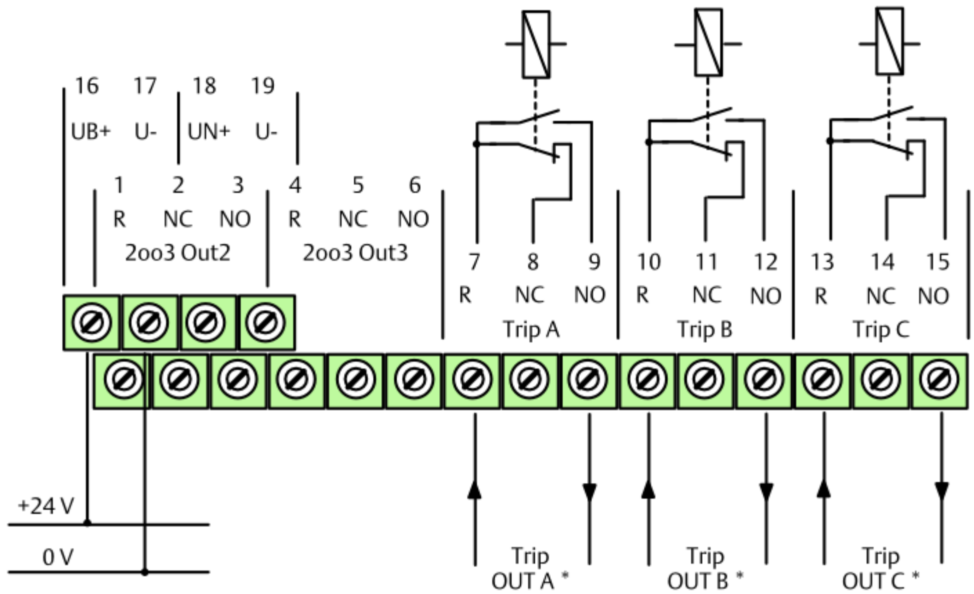
Figure 9-3: Connection example power supply and trip-relay, A6371/00



* Both 2oo3 trip outputs Trip 1 and Trip 2 must be connected in series to be connected to the actuator.

The make contact of the trip relays is closed if no trip is present. Both make contacts are opened in case of a trip or supply voltage failure.

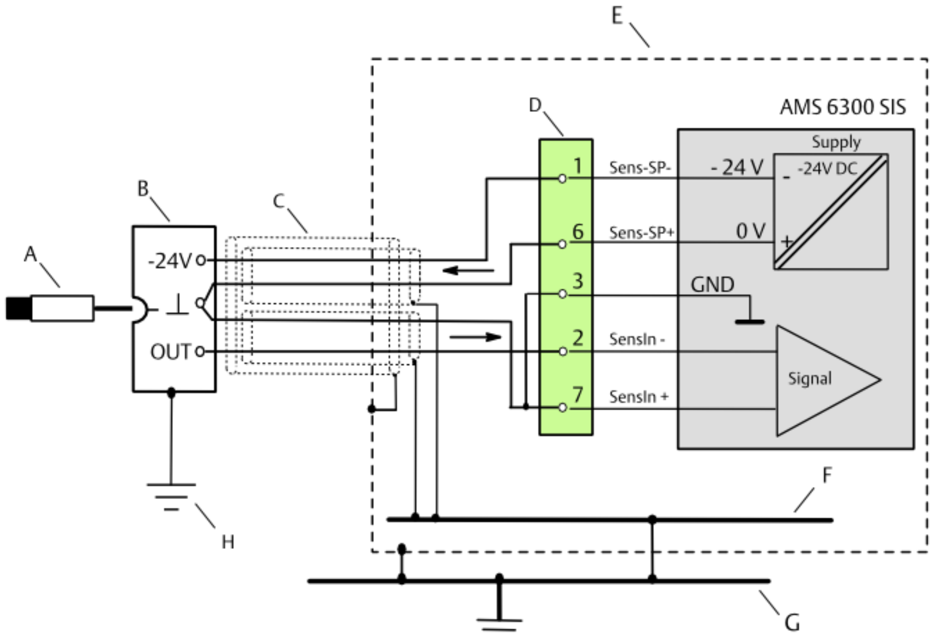
Figure 9-4: Connection example power supply and trip-relay, A6371/10



* For the safety path at use in safety related systems only the make contacts of the trip relays must be used.

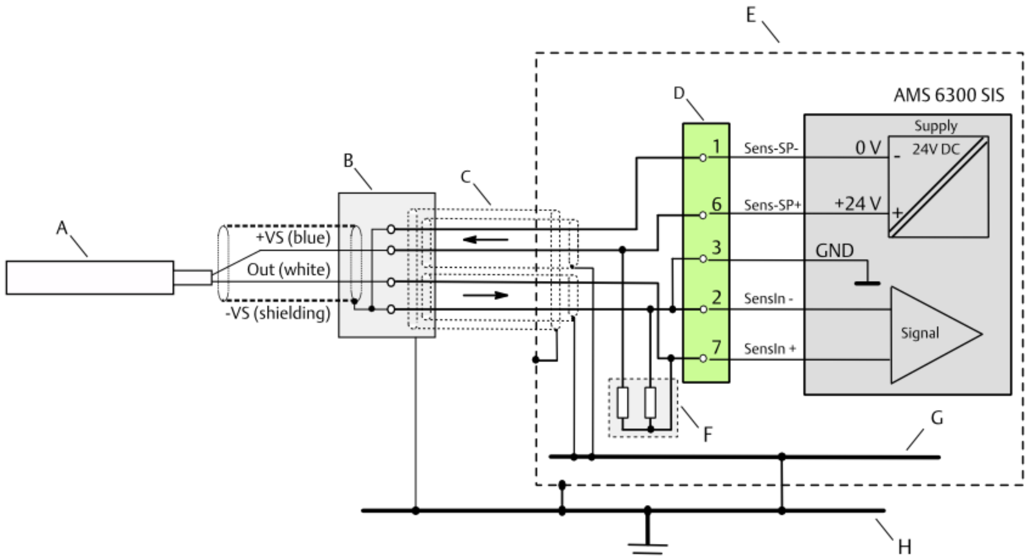
The make contact of the trip relays is closed if no trip is present. The make contacts are opened in case of a trip or supply voltage failure.

Figure 9-5: Connection of eddy current measuring chains PR 642x + CON 0x1



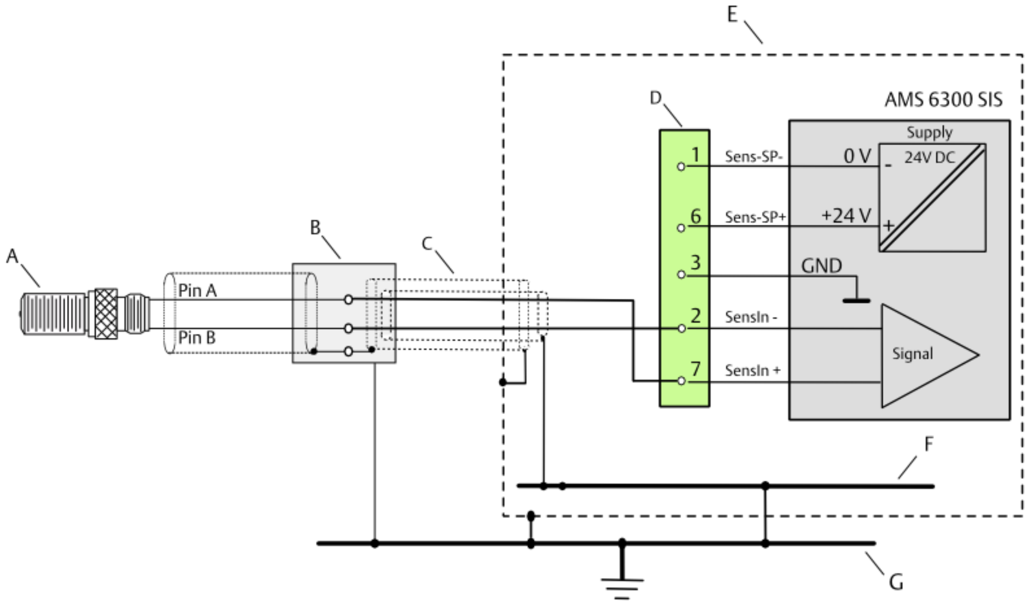
A. *Eddy current sensor PR 642x*
B. *Signal converter CON 0x1*
C. *Cable LIYCY-CY 2x2x0.25mm² (maximum 400 m)*
D. *9-pole sub-D terminal block monitor A, B, and C (analog signals)*
E. *Cabinet*
F. *Cabinet ground*
G. *Protective ground*
H. *Connection housing/protective ground (machine ground), only CON 011*

Figure 9-6: Connection example with PR 9376 Hall-effect sensor



A. *Hall effect sensor PR 9376*
B. *Terminal box*
C. *Cable LIYCY-CY 2x2x0.25mm^2 (maximum 400 m)*
D. *9-pole sub-D terminal block monitor A, B, and C (analog signals)*
E. *Cabinet*
F. *Load resistors for **Channel OK** detection*
G. *Cabinet ground*
H. *Protective ground*

Figure 9-7: Connection example with variable reluctance sensor



A. *Variable reluctance sensor (VR sensor)*
B. *Terminal box*
C. *Cable LIYCY-CY 2x2x0.25mm^2 (maximum 400 m)*
D. *9-pole sub-D terminal block monitor A, B, and C (analog signals)*
E. *Cabinet*
F. *Cabinet ground*
G. *Protective ground*

9.2 Certificates

CE

EMERSON

EU-Declaration of Conformity (Translation)

We: epro GmbH, Jöbkesweg 3, 48599 Gronau

declare under our sole responsibility that following product(s):

AMS 6300 SIS

Logic for speed and detection of rotational direction

Part number	Hardware-Revision	Firmware-Revision
A6370D	10,11, or 12	Firmware-Safe-µC 2.00 Firmware-Sub-µC 2.xx
A6370D/DP	10,11, or 12	Firmware-Safe-µC 2.00 Firmware-Sub-µC 2.xx
A6371/00	10,11, or 12	
A6371/10	10,11, or 12	

are in conformity with the terms of the directives mentioned below including any amendment valid at the date of declaration:

2014/30/EU	Electromagnetic compatibility
2011/65/EU	The restriction of the use of certain hazardous substances in electrical and electronic equipment
2006/42/EC	Machinery Directive

Following harmonized standards have been applied:

2014/30/EU	EN 61326-1	Electrical equipment for measurement, control and laboratory use. EMC requirements. Part 1. General requirements
2011/65/EU	EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
2006/42/EC	DIN EN 62061	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

Authorized person for technical documentation:

Bruno Hecker, Jöbkesweg 3, 48599 Gronau

Gronau, 31 January 2023

Place, Date — **Managing Director** — **Quality**

B. Hecker

TÜV NORD

DAkkS
Deutsche
Akkreditierungsstelle
D-ZE-11074-01-00

Certificate

No. 1435.IM.181922/22, V1.0

TÜV NORD Systems GmbH & Co. KG hereby certifies to

Emerson Automation Solutions
epro GmbH

Jöbkesweg 3
48599 Gronau

that the safety-related

6300 SIS
Overspeed Protection System

meets the requirements listed in the following standards.

IEC 61508:2010; capable up to SIL 3

DIN EN 62061:2016; capable up to SIL_{CL} 3

DIN EN 61511-1:2019; capable up to SIL 3

Certification program Leittechnik (SEB-ZE-SEECERT-VA-320-20, Rev. 5.1/ 04.19)

Basis of certification is the report 1435.IM.181922/22TB in the valid version. This certificate entitles the usage of the adjacent conformity mark.

Valid until: 2027-12-15
Reference: 8120299364

Hamburg, 2022-12-15

B. Pfuff
Bianca Pfuff

Voluntary Certification
TÜV NORD
TÜV NORD Systems GmbH & Co. KG
Safety Approved
6300 SIS
IEC 61508:2010; SIL 3
DIN EN 62061:2016; SIL_{CL} 3
DIN EN 61511-1:2019; SIL 3
1435.IM.181922/22

Certification Body SEECERT
TÜV NORD Systems GmbH & Co. KG
Große Bahnstraße 31, 22525 Hamburg, Germany

UK CA

EMERSON

UKCA-Declaration of Conformity

We, the manufacturer: epro GmbH, Jöbkesweg 3, 48599 Gronau, Germany
declare under our sole responsibility that following product(s):

Product designation:	**AMS 6300 SIS**
Product description:	**Logic for speed and detection of rotational direction**
Part numbers	**A6370D** **A6370D/DP** **A6371/00** **A6371/10**

are in conformity with the terms of the directives mentioned below including any amendment valid at the date of declaration:

S.I. 2016 No. 1091	Electromagnetic Compatibility Regulations 2016
S.I. 2012 No. 3032	The restriction of the use of certain hazardous substances in electrical and electronic equipment

Following standards have been applied:

S.I. 2016 No. 1091	EN 61326-1	Electrical equipment for measurement, control and laboratory use. EMC requirements. Part 1. General requirements
S.I. 2012 No. 3032	EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Authorized person for technical documentation:
Bruno Hecker, Jöbkesweg 3, 48599 Gronau, Germany

Authorized Representative:
Emerson Process Management Limited,
company No 00671801
Meridian East,
Leicester
LE19 1UX, United Kingdom
Regulatory Compliance Department
email:*ukproductcompliance@emerson.com*
Phone: +44 11 6282 23 64

M. Fränzer
Managing Director

B. Hecker

B. Hecker
Quality

Place, Date: Gronau, 13 September 2022

MHM-97442
Rev. 2.07
2023

Emerson
12001 Technology Drive
Eden Prairie, MN 55344 USA
T 1(952)828-3000
www.Emerson.com

Emerson
835 Innovation Drive
Knoxville, TN 37932 USA
T +1 865-675-2400
F +1 865-218-1401
www.Emerson.com

Emerson
Jöbkesweg 3
48599 Gronau
Germany
T +49 2562 709 0
F +49 2562 709 401
www.Emerson.com/ams

EMERSON™