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, 12, or 13	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, 12, or 13	Firmware Safe-µC 2.00[1] Firmware Sub-µC 2.00[1]
Backplane	A6371/00 (Trip Voted)	10, 11, 12, or 13	N/A
	A6371/10 (Trip Not Voted)	10, 11, 12, or 13	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 measuring cables with BNC-SMB adapters

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
	A6381	3

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

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

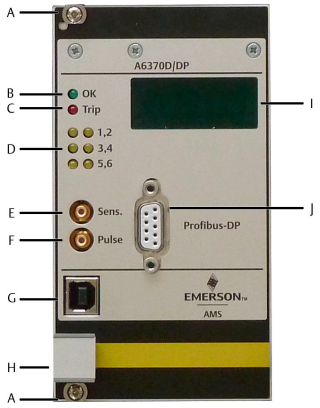
1 *No mixed card types within a system.*

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)

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