Manual
Series D521
(Revision 13)

Product Manual

Original Instructions

valid for versions

D521.02 2 Relay Outputs as SPDT relays
D521.04 4 Relay Outputs (2 as SPDT relays, 2 as PhotoMOS relays)
D521.10 1 Analog Output
D521.12 2 Relay Outputs as SPDT relays + 1 Analog Output
D521.14 4 Relay Outputs (2 as SPDT relays, 2 as PhotoMOS relays) + 1 Analog Output

Note: Suffix M (for example D521.12M) means extended operational temperature range -20 °C .. +65 °C

D521 Front View

Single Channel Speed Monitor
for
increased safety requirements up to SIL1

Table of Contents

1 Technical Specifications

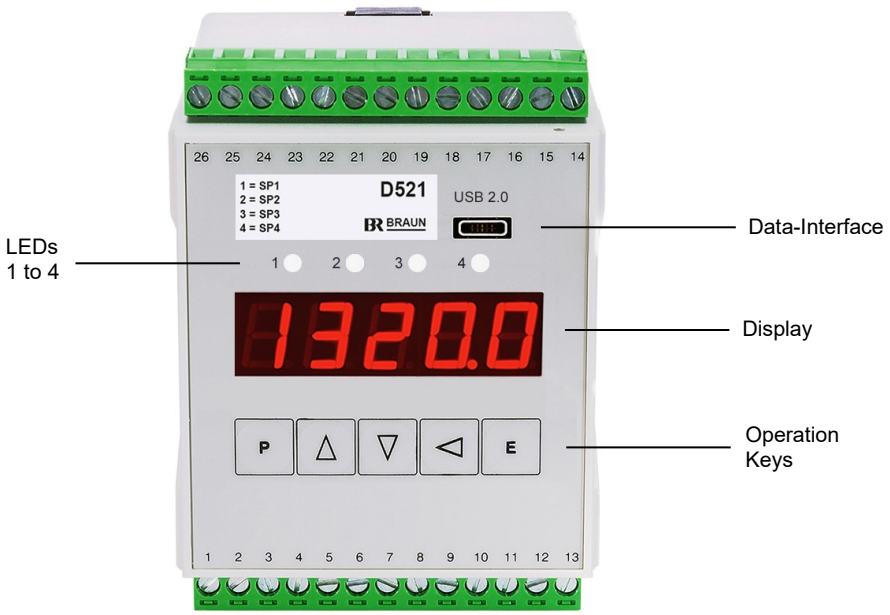
Design	Snap-on-track plastic enclosure for 35 mm rail, field mounting enclosure (Option -G) on request. Dimensions: see chapter 7.3 Weight: standard version approx. 0.3 kg, option –G approx. 1.0 kg	
Installation Conditions	Ambient temperature in operation:	
	Without suffix M:	0°C...+60°C
	With suffix M:	-20°C...+65°C
	Ambient temperature in storage:	-40°C...+85°C
	Electrical insulation grade: I	
	Voltage grade: I	
	Protection grade standard version:	terminals IP20 enclosure IP 40
	Protection grade option -G:	IP65
Power Supply	Supply voltage:	20...265 volts uc
	Power consumption:	5 W resp. 5 VA
Signal input and Sensor supply	Response levels:	see chapter 2.9 resp. 2.10
	Input impedance (I):	100 kohms
	Sensor supply:	approx. 13 volts, max. 60 mamps resp. 8 volts with 1k load resistor (incorporated)
	Sequence:	5 msec - 9.999 sec (programmable)
Measurement	Accuracy: ± 0.005 % of measurement, ± 1 in LSD	
Relay Outputs	2 alarm outputs with SPDT relay contacts	
(Versions D521.02 D521.04 D521.12 D521.14)	Switching voltage:	min. 10 millivolts, max. 250 volts AC/DC
	Switching current:	min. 10 µamp, max. 2 amp AC, 1 amp DC
	Switching capacity:	max. 30 W, 62.5 VA into ohmic load only
	Rating resistive:	max. 0.5 A 125 Vac or 1 A 30 Vdc
	(inductive loads need overload protection)	
(Versions D521.04 D521.14)	2 additional alarm outputs with PhotoMOS relay contacts	
	Switching voltage:	min. 10 millivolts, max. 60 volts DC
	Switching current:	min. 10 µamp, max. 0.1 amp DC
Analog Output	Isolated and programmable with range 0/2-10volts / 0/4-20mamp	
(Versions D521.10 D521.12 D521.14)	Resolution:	12 bit
	Max. load:	750 ohms
	Linearity error:	< 0.1 %
	Temperature stability:	±0,02 %/°C within a range of 0...60°C.
Display	5 digits LED red, 10 mm, with adjustable decimal point	
Programming Interface	with interface software IS-RS232-S and RS232 up to serial number 1910239999: with cable L3D01 for PC with RS232 USB2.0 from serial number 1910240001: with cable L3D07 for PC with USB-A or with cable L3D08 for PC with USB-C	

2 Description

2.1 Function

The device measures the speed of rotating equipment such as turbines, compressors or expanders and monitors it versus setpoints and converts it into an analog output.
Parameters may be set via front keyboard and display or via the USB2.0 data interface.

2.2 Display and Operating Elements



2.3 Display

During normal operation, the speed will be displayed.

2.4 Status LEDs

LEDs 1 to 4 are on if the corresponding output relays of SP1 to SP4 are energized.

2.5 Functions during normal operation

Key ◁ : Reset of latched max./min. -values speed
Key △ : Display of latched max. speed
Key ▽ : Display of latched min. speed
Keys ◁ and E : Reset of latched alarms

2.6 Event Codes on Display

-E1-	:	Wrong code figure in step P00.00
SE-01	:	Sensor fault or signal lead break

2.7 Measuring Principle

Measurement is based on the frequency of the pulse sequence representing the speed. Basic quantity is the time between one or more of its pulses. An automatic function determines this number, in order to maintain a minimum period of time for every measurement to be extended over. This time minimum is programmable to 5 milliseconds or more, thus establishing a corresponding averaging and stabilization of measurements.

The corresponding speed value in terms of RPM, by which the display, the alarm circuit, and the analog output are reading, computes from these measurements. This process further considers the programmed application data (relation between machine speed and signal frequency).

2.8 Performance at Signal Break

In normal operation, the function closely tracks the input sequence, with the programmed performance. After a sudden interrupt of the input pulses, the unit reduces the readings following an automatic step-down sequence. This starts as fast as the most recent measuring sequence before interrupt but then decreases slower and slower (reciprocal) until it meets the programmed low end.

2.9 Signal Input V-Path (volts) Terminal 14

Accepting any sensor which meets these conditions:

- High Level path:
  Response level on/off : >7/<5 volts DC with programmable hysteresis
  Maximum voltage: 100 volts
  Input impedance: 100 kOhm
  Frequency range: 0 … 50 kHz
  Sensor supply: approx. 13 volts / 60 mamps.

- 2-leads npn-NAMUR sensors DIN 19234 (if programmed):
  Current level on/off >2.0 mamps / < 1,2 mamps with programmable hysteresis
  Sensor supply: 8 volts with 1 kOhm load resistor (incorporated).

2.10 Signal Input mV-Path (millivolts) Terminal 15 (for MPU or VR sensors)

Accepting MPU or VR sensors of other low level sensors or such with superposed DC-level, or such missing the above specified V-levels. Sensitivity (min amplitude required) depending on signal frequency (with sinusoidal waveform)

500 millivolts RMS	between	0.1 Hz … 1 Hz
50 millivolts RMS	between	1 Hz …10 kHz
500 millivolts RMS	above	10 kHz

Max voltage 50 Vpp with max 35 Vdc superposed.
Input impedance approx. 50 kohms.

2.11 Sensor monitoring

Monitoring sensor current drain, output voltage, and signal activity (if applicable to sensor type).

2.12 Reserved

2.13 Alarms (D521.02, D521.04, D521.12, D521.14)

Two or four individual setpoints control an own signal output (2 as SPDT relays contacts, 2 as option with PhotoMOS relay contacts). Each with individually programmable response characteristics, and each with programmable starter.

2.14 Analog Output (D521.10, D521.12, D521.14)

Output signal isolated and linear as current 0/4… 20 mamps into 750 Ohms max load, or voltage 0/2 volts …10 volts under max. 10 mamps load.
Live zero as well as high and low end of conversion programmable.

2.15 Signal Pulse Output 1

Repeating the input pulse signals (undivided) by the same sequence, as square wave pulses of approx. 10 volts and 1 kOhm source impedance. Same reference as input.

2.16 Signal Pulse Output 2

Isolated (passive) output by optocoupler, for max load 30 volt / 10 mamps. Pulse sequence as reduced by the input pulse divider. Max output frequency 12 kHz (at a 1:1 duty input signal). Output must be powered externally.

3 Model No. Code

No.	Analog Output	No. of Alarms
D521.02	no	2 (2 SPDT relay outputs)
D521.04	no	4 (2 SPDT relay outputs + 2 PhotoMOS relay outputs)
D521.10	yes	0 none
D521.12	yes	2 (2 SPDT relay outputs)
D521.14	yes	4 (2 SPDT relay outputs + 2 PhotoMOS relay outputs)

4 Parameters

4.1 Summary of parameters and their default values as set on delivery

Param. No.	Default value	Parameter Function
P00.xx		**Code figure, Parameter Lock, Front side Reset of Alarms**
P00.00	0000	Code figure
.01	0000	New code figure
.02	0	Front side Parameter Lock: 0: locked / 1: enabled
.03	0000	Minimum Measuring Period (in xxxx milliseconds)
.04	000	Starter Time Period (in xxx sec)
P01.xx		**Input Scaling**
P01.00	0	Decimals of input frequency
.01	00100	Value of nominal input frequency in Hz
.02	0	Decimals of speed value
.03	00100	Nominal speed (e.g. in RPM)
.04	00001	Lower limit of the speed range
.05	0	Hysteresis of input response level (0 : A5S sensor, 1 : MPU or VR or NAMUR or A1S3 sensor)
.06	1	Reserved for future applications
.07	0	Reserved for future applications
.08	1	Sensor monitoring: 0: off / 1: on / 2: on, latched
.09	1	Mode of sensor monitoring: 0: none / 1: current / 2: voltage / 3: both / 4 : Reserve / 5 : Reserve
.10	001	Fix value 001
P02.xx		**Display**
P02.00	0	LSDs on zero
.01	0.3	Updating sequence (in x.x seconds)
		Continued on next page

Param. No.	Default value	Parameter Function
P03.xx		**Analog Output**
P03.00	10000	High-end speed value
.01	00000	Low-end speed value
.02	1	Zero level: 0 : dead zero / 1 : live zero
.03	1	Output mode: 0 : signal voltage / 1 : current
.04	0	Output level at sensor fault: 0: no change / 1: min / 2: max
.05	0	Output direction: 0/4..20 mamps (0/2..10 volts) / 1 : 20...4/0 mamps (10..0/2 volts)
P04.xx		**Alarm SP1**
P04.00	01100	Setpoint (by same terms as programmed in P01.03)
.01	05.0	Hysteresis bandwidth for SP: 00.1….99.9 % of setpoint
.02	1	Hysteresis location: 0 : above / 1 : below
.03	0	Relay state at ' n > SP ': see table of parameter description
.04	0	Starter function effective for setpoint SP1: 0 : no / 1 : yes
.05	0	Alarm state during starter phase: 0 : ' n < SP ' / 1 : ' n > SP '
.06	0	Alarm state at sensor fault: 0 : acc. to variable / 1 : ' n < SP ' / 2 : ' n > SP '
P05.xx		**Alarm SP2**
P05.00	01200	Setpoint (by same terms as programmed in P01.03)
.01	05.0	Hysteresis bandwidth for SP: 00.1….99.9 % of setpoint
.02	1	Hysteresis location: 0 : above / 1 : below
.03	0	Relay state at ' n > SP ': see table of parameter description
.04	0	Starter function effective for setpoint SP2: 0 : no / 1 : yes
.05	0	Alarm state during starter phase: 0 : ' n < SP ' / 1 : ' n > SP '
.06	0	Alarm state at sensor fault: 0 : acc. to variable / 1 : ' n < SP ' / 2 : ' n > SP '
P06.xx		**Alarm SP3**
P06.00	01300	Setpoint (by same terms as programmed in P01.03)
.01	05.0	Hysteresis bandwidth for SP: 00.1….99.9 % of setpoint
.02	1	Hysteresis location: 0 : above / 1 : below
.03	0	Relay state at ' n > SP ': see table of parameter description
.04	0	Starter function effective for setpoint SP3: 0 : no / 1 : yes
.05	0	Alarm state during starter phase: 0 : ' n < SP ' / 1 : ' n > SP '
.06	0	Alarm state at sensor fault: 0 : acc. to variable / 1 : ' n < SP ' / 2 : ' n > SP '
P07.xx		**Alarm SP4**
P07.00	01400	Setpoint (by same terms as programmed in P01.03)
.01	05.0	Hysteresis bandwidth for SP: 00.1….99.9 % of setpoint
.02	1	Hysteresis location: 0 : above / 1 : below
.03	0	Relay state at ' n > SP ': see table of parameter description
.04	0	Starter function effective for alarm SP4: 0 : no / 1 : yes
.05	0	Alarm state during starter phase: 0 : ' n < SP ' / 1 : ' n > SP '
.06	0	Alarm state at sensor fault: 0 : acc. to variable / 1 : ' n < SP ' / 2 : ' n > SP '
P08.xx		**Data interface**
P08.00	3	Baudrate: 0 : 300 / 1 : 1200 / 2 : 9600 / 3 : 19200 / 4 : 38400
.01	001	Device no.: 001 …125

4.2 Setting the Parameters via Interface

4.2.1 Setting the Parameters via USB 2.0 Interface (from serial number 1910240001)

With interface software IS-RS232-S from BRAUN and USB adapter cable L3D07 (for PC with USB-A) or L3D08 (for PC with USB-C).

4.2.2 Setting the Parameters via RS232 Interface (up to serial number 1910239999)

With interface software IS-RS232-S from BRAUN and adapter cable L3D01 (PC must have a 9pole SUB-D RS232 Interface).

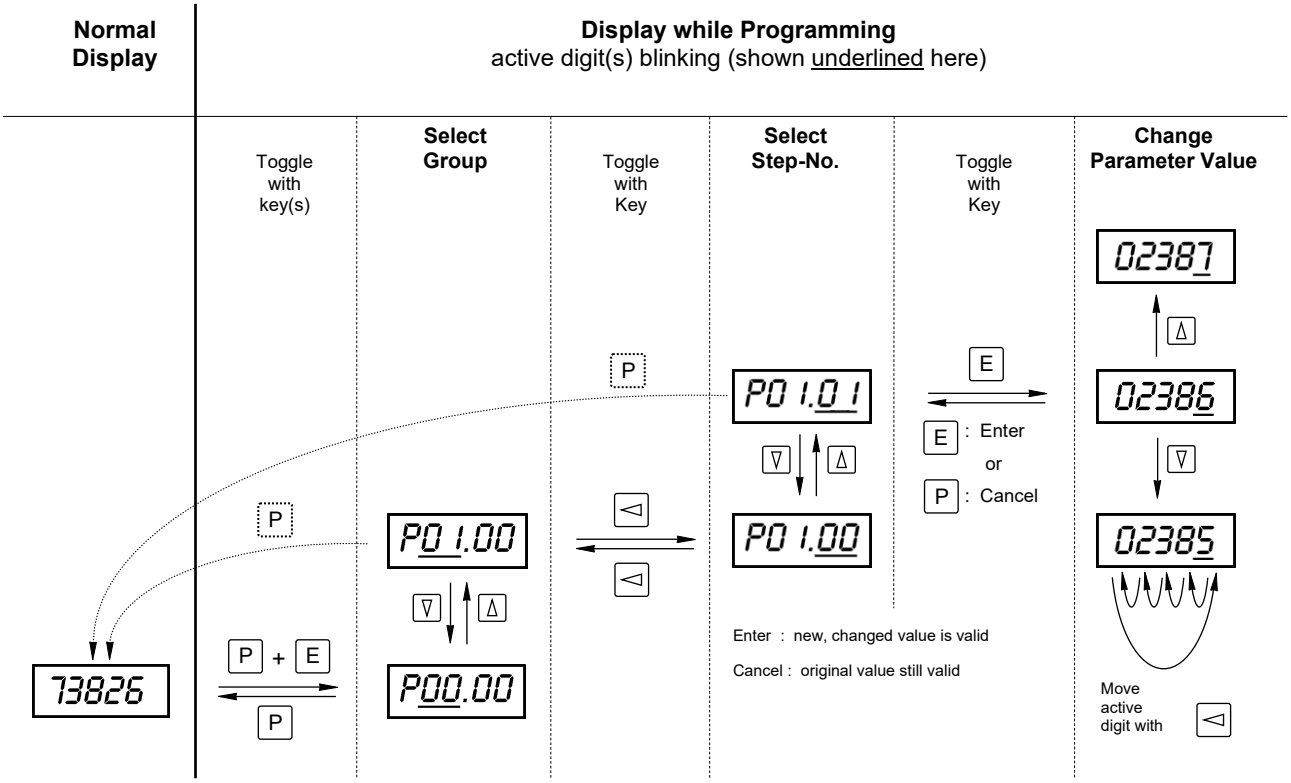
4.3 Setting the parameters via Front Keyboard

Principle: Select a parameter via its ‚name' **Pgg.ss**,
in that **gg** : Parameter-group number and
ss : Step-number within the group,

then display the value and alter if required.

Procedure:
Initiate programming phase by pressing keys [P] and [E] together;
instead of the normal display P00.00. appears
Select the group or step number with keys [△] , [▽] .
Switch between Groups and Step Fields with the [◁] . key
Current value of the Parameters is displayed with key [E] .
Select active position with the [◁] . key
Adjust the number in the active field with keys [△] , [▽] .
Acknowledge and set with key [E] , Discard (original value remains) with key [P] .
Return to operational mode with the [P] key.

See example below: Change parameter P01.01 from 2386 to 2387 or 2385.



5 Description of Parameters and their Settings

Parameter Group P00.xx **Code Figure, Parameter Lock, Front side Reset of Alarms**	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P00.00 **Code Figure** Range: 0000 .. 9999	If the parameters are locked (see P00.02), the code figure must be entered prior to any change of other parameters. If the code figure is not correct, -E 1- is displayed. Without code figure and P00.02: 0 the values of all parameters may be inspected, but not changed.
P00.01 **New Code Figure** Range: 0000 .. 9999	A new code figure may be set in P00.01. Then it replaces the previous one.
P00.02 **Front side Parameter Lock** Range: 0 .. 1	Setting: 0 : Parameters are locked, front side change only possible with code figure 1 : Parameters unlocked, front side change of parameter values possible
P00.03 **Minimum Measuring Period in milliseconds** Range: 0005 .. 9999 (5 .. 9999 milliseconds)	The measurement is based on a time interval measurement over a (variable) number of input signal pulses. A programmable minimum measuring period thus will be maintained, automatically including more input pulses into every measurement with increasing input frequency. This establishes an averaging over the programmed period of time, which helps to stabilize the measurements, specifically with fluctuating variables. As a standard, a minimum time of 300 milliseconds is recommended. A shorter period should be selected to trace a fast variation (by the analog signal or alarm). A longer period however may be selected to stabilize the measurement against a fluctuating process variable. The setting of P00.03 defines the minimum measuring period of time, in terms of milliseconds, within a range of 0005....9999 milliseconds. A setting less than 0005 is possible, but minimum measuring time will still be 5 msec.
P00.04 **Starter Time Period** Range: 000 .. 999 [sec]	This step sets the starter time period (duration). The starter phase state lasts from the beginning of the external starter signal plus the programmed time elapse following its end. Valid for all setpoints with the activated starter.

Parameter Group P01.xx
Measurement Configuration, Sensor Monitoring

Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P01.00 to P01.03: **Scaling**	Scaling defines the relation between the input signal frequency (in terms of Hz), and the corresponding display (e.g. in RPM and decimal position required by the application). Both values are freely programmable by their decimals and numerical amount. Of course, they must refer to the same operation level. This reference point is recommended close to the high end of the intended operation range. In later operation, however, it may be overrun without error. Example: A rotating shaft to be measured carries 36 slots. At a shaft speed of 1500 RPM, this produces a signal frequency of 1500 × 36 pulses per minute = 54,000 pulses per minute = 54,000 ÷ 60 Hz = 900 Hz. (Presuming the predivider is set to 001). Therefore, 900 (Hz) and 1500 (RPM) are the data-set to be programmed in the corresponding program steps: Step P01.00 : parameter = 0 (= no decimal) P01.01 : parameter = 00900 P01.02 : parameter = 0 (= no decimals) P01.03 : parameter = 01500
P01.00 **Number of decimals for P01.01** Range: 0 .. 4	
P01.01 **Input frequency in Hz** Range: 00001 . .99999	
P01.02 **Number of decimals for P01.03** Range: 0 .. 4	
P01.03 **Speed (RPM)** Range: 00001 .. 99999	

Number of slots	Possible pair of values	
	Nominal Frequency (Hz)	Nominal Speed (RPM)
30	1750	3500
36	2100	3500
60	6000	6000
72	7200	6000

P01.04 **Low end of operating range** Range: 00000 .. 99999	If the speed value falls lower than this level, the measurement will be canceled to zero. This also applies to the analog output and the alarms. The low end is entered directly as RPM.
P01.05 **Hysteresis of the** **Input Response Level** Range: 0 .. 1	Hysteresis of the input response level: Setting: 0 : Hysteresis approx. 0.8 volts (for A5S.. sensors) 1 : Hysteresis approx. 0.1 volts (for MPU or VR or NAMUR or A1S3.. sensors)
P01.06 Reserved for future applications	
P01.07 Reserved for future applications	

Parameter Group P01.xx (continued) **Measurement Configuration, Sensor Monitoring**	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P01.08 **Sensor monitoring on/off** Range: 0 .. 2	If the sensor A5S is monitored, the fault alarm may be latched until it is reset. Setting: 0 : off (sensor monitor disabled) 1 : on 2 : on, latched Note: If P01.08 set to 0, Step P01.09 is meaningless. **With all other sensors types P01.08 must be 0.**
P01.09 **Mode of sensor monitoring** Range: 0 .. 5	Setting: 0 : Without monitoring 1 : Checks sensor current drain 2 : Checks signal voltage level volt sensor at stand still 3 : Current drain and voltage level 4 : Reserve 5 : Reserve Note: The voltage level check is only possible with Braun sensor type A5S... In this instance a signal lead break between sensor and D521 will be detected at stand still of the machine. This check requires a jumper between terminals 14 and 16. Maximum admissible signal voltage is 30Vdc. **- For Ex Applications with SIL2 requirements (with A5S1.. and D461)** P01.09 must be set to 2. **- For Non-Ex Applications with SIL2 requirements (with A5S0)** P01.09 must be set to 3.
P01.10 Fix value 001	

Parameter Group P02.xx **Display**	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P02.00 **LSDs on zero** Range: 0 .. 2	If the speed display uses 4 or more digits, for application reasons, the lesser significant digits (LSD) may appear fluctuating. To avoid irritations by not significant digits, a number of them may be permanently kept at zero. Set the parameter to the number of LSDs to be kept on zero.
P02.01 **Display updating sequence** Range: 0.1 .. 9.9 (seconds)	Independent from the response time used for other functions, the display may have its own up-dating sequence - again in the interest of stabilized and well legible readings. Set the time between updates in steps of 0.1 sec. A recommended value is 0.3 sec.

Parameter Group P03.xx **Analog Output**	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P03.00 **High end of analog output** Range: 00001 .. 99999 (e.g. RPM)	The high end (corresponding to 20 mamps) is programmed by the same terms as used in step P01.03 (e.g. in RPM).
P03.01 **Low end of analog output** Range: 00001 .. 99999 (e.g. RPM)	The low end (corresponding to 0 resp. 4 mamps) is programmed by the same terms as used in step P01.03.
P03.02 **Live Zero** Range: 0 .. 1	The analog signal can be output without or with live zero. Setting: 0 : " without live zero" = 0...20 mA 1 : "with live zero" = 4...20 mA
P03.03 **Output mode** Range: 0 .. 1	Setting: 0 : signal voltage (10 V) 1 : current (20 mA)
P03.04 **Forced output level at sensor fault condition** Range: 0 .. 2	Setting: 0 : no, output follows measured speed 1 : min: output goes to < 0 mamps 2 : max: output goes to approx. 21 mamps
P03.05 **Characteristics of analog output increasing/decreasing** Range: 0 .. 1	Setting: 0 : normal (0/4. .20 mA with increasing speed) 1 : inverted (20...0/4 mA with increasing speed)

Parameter Group P04.xx **Alarm SP1**	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P04.00 **Setpoint SP1** Range: 00001 .. 99999	Setpoint SP1 is programmed in the same terms (e.g. RPM) as selected for the display of the variable in step P01.03.
P04.01 **Hysteresis bandwidth of SP1** Range: 00.1 .. 99.9 (xx.x % of SP1)	The hysteresis is the margin between condition "excess" (>) and "no excess" (<), defined by its bandwidth. Without hysteresis, the alarm might be unstable at the switching point (relay chattering) if the speed surpasses the setpoint slowly). The hysteresis bandwidth is set as a percentage of the setpoint.
P04.02 **Hysteresis position of SP1** Range: 0 .. 1	The hysteresis band may be placed above or below setpoint. "Above" means, the alarm goes to excess state (>), when the speed exceeds "set-point plus tolerance", and it cancels to no-excess (<), when the speed drops below setpoint. "Below" means, the alarm goes to excess (>), when the speed exceeds the setpoint, and it cancels to no-excess (<), when the speed drops below "set-point minus tolerance". Setting: 0 : hysteresis above SP1 (recommended when monitoring n < SP1) 1 : hysteresis below SP1 (recommended when monitoring n > SP1)
P04.03 **Relay state at ' n > SP1 '** Range: 0 .. 1	Without power supply, the alarm outputs are non-conducting, and the relays are de-energized. To consider safety aspects of the application, this No-Power condition can be assigned to either alarm > or < condition. Setting: 0 : relay de-energized at ' n < SP1 ' 1 : relay de-energized at ' n > SP1 '
P04.04 **Starter function effective for Setpoint SP1** Range: 0 .. 1	The starter function may be effective for each setpoint individually. Thereby it is possible, for instance, to disable a low speed alarm during the starter phase, whereas a high speed alarm remains active all the time. Setting: 0 : starter not effective for setpoint SP1 1 : starter effective for setpoint SP1
P04.05 **Relay state at starter condition** Range: 0 .. 1	At starter condition, the alarm may be forced to states ' n < SP1 ' or ' n > SP1' (if starter function is effective for the alarm). Setting: 0 : ' n < SP1 ' 1 : ' n > SP1 '
P04.06 **Forced state SP1 at sensor fault condition** Range: 0 .. 2	At sensor fault, the alarm may be forced to states ' n < SP1 ' or ' n > SP1'. Setting: 0 : no forced state, state acc. to measured speed 1 : state forced to ' n > SP1' 2 : state forced to ' n < SP1 '

Parameter Group P05.xx **Alarm SP2**	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P05.00 **Setpoint SP2** Range: 00001 .. 99999	Setpoint SP2 is programmed in the same terms (e.g. RPM) as selected for the display of the variable in step P01.03.
P05.01 **Hysteresis bandwidth of SP2** Range: 00.1 .. 99.9 (xx.x % of SP)	The hysteresis is the margin between condition "excess" (>) and "no excess" (<), defined by its bandwidth. Without hysteresis, the alarm might be unstable at the switching point (relay chattering) if the speed surpasses the setpoint slowly). The hysteresis bandwidth is set as a percentage of the setpoint.
P05.02 **Hysteresis position of SP2** Range: 0 .. 1	The hysteresis band may be placed above or below setpoint. "Above" means, the alarm goes to excess state (>), when the speed exceeds "set-point plus tolerance", and it cancels to no-excess (<), when the speed drops below setpoint. "Below" means, the alarm goes to excess (>), when the speed exceeds the setpoint, and it cancels to no-excess (<), when the speed drops below "set-point minus tolerance". Setting: 0 : hysteresis above SP2 (recommended when monitoring n < SP2) 1 : hysteresis below SP2 (recommended when monitoring n > SP2)
P05.03 **Relay state at ' n > SP2 '** Range: 0 .. 1	Without power supply, the alarm outputs are non-conducting, and the relays are de-energized. To consider safety aspects of the application, this No-Power condition can be assigned to either alarm > or < condition. Setting: 0 : relay de-energized at ' n < SP2 ' 1 : relay de-energized at ' n > SP2 '
P05.04 **Starter effective for SP2** Range: 0 .. 1	The starter function may be effective for each setpoint individually. Thereby it is possible, for instance, to disable a low speed alarm during the starter phase, whereas a high speed alarm remains active all the time. Setting: 0 : starter not effective for setpoint SP2 1 : starter effective for setpoint SP2
P05.05 **Relay state at starter condition** Range: 0 .. 1	At starter condition, the alarm may be forced to states ' n < SP2 ' or ' n > SP2' (if starter function is effective for the alarm). Setting: 0 : ' n < SP2 ' 1 : ' n > SP2 '
P05.06 **Forced state SP2 at** **sensor fault condition** Range: 0 .. 2	At sensor fault, the alarm may be forced to states ' n < SP2 ' or ' n > SP2'. Setting: 0 : no forced state, state acc. to measured speed 1 : state forced to ' n > SP2' 2 : state forced to ' n < SP2 '

Parameter Group P06.xx **Alarm SP3**	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P06.00 **Setpoint SP3** Range: 00001 .. 99999	Setpoint SP3 is programmed in the same terms (e.g. RPM) as selected for the display of the variable in step P01.03.
P06.01 **Hysteresis bandwidth of SP3** Range: 00.1 .. 99.9 (xx.x % of SP)	The hysteresis is the margin between condition "excess" (>) and "no excess" (<), defined by its bandwidth. Without hysteresis, the alarm might be unstable at the switching point (relay chattering) if the speed surpasses the setpoint slowly). The hysteresis bandwidth is set as a percentage of the setpoint.
P06.02 **Hysteresis position of SP3** Range: 0 .. 1	The hysteresis band may be placed above or below setpoint. "Above" means, the alarm goes to excess state (>), when the speed exceeds "set-point plus tolerance", and it cancels to no-excess (<), when the speed drops below setpoint. "Below" means, the alarm goes to excess (>), when the speed exceeds the setpoint, and it cancels to no-excess (<), when the speed drops below "set-point minus tolerance". Setting: 0 : hysteresis above SP3 (recommended when monitoring n < SP3) 1 : hysteresis below SP3 (recommended when monitoring n > SP3)
P06.03 **Relay state at ' n > SP3 '** Range: 0 .. 1	Without power supply, the alarm outputs are non-conducting, and the relays are de-energized. To consider safety aspects of the application, this No-Power condition can be assigned to either alarm > or < condition. Setting: 0 : relay de-energized at ' n < SP3 ' 1 : relay de-energized at ' n > SP3 '
P06.04 **Starter effective for SP3** Range: 0 .. 1	The starter function may be effective for each setpoint individually. Thereby it is possible, for instance, to disable a low speed alarm during the starter phase, whereas a high speed alarm remains active all the time. Setting: 0 : starter not effective for setpoint SP3 1 : starter effective for setpoint SP3
P06.05 **Relay state at starter condition** Range: 0 .. 1	At starter condition, the alarm may be forced to states ' n < SP3 ' or ' n > SP3' (if starter function is effective for the alarm). Setting: 0 : ' n < SP3 ' 1 : ' n > SP3 '
P06.06 **Forced state SP3 at** **sensor fault condition** Range: 0 .. 2	At sensor fault, the alarm may be forced to states ' n < SP3 ' or ' n > SP3'. Setting: 0 : no forced state, state acc. to measured speed 1 : state forced to ' n > SP3' 2 : state forced to ' n < SP3 '

Parameter Group P07.xx **Alarm SP4**	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P07.00 **Setpoint SP4** Range: 00001 .. 99999	Setpoint SP4 is programmed in the same terms (e.g. RPM) as selected for the display of the variable in step P01.03.
P07.01 **Hysteresis bandwidth of SP4** Range: 00.1 .. 99.9 (xx.x % of SP)	The hysteresis is the margin between condition "excess" (>) and "no excess" (<), defined by its bandwidth. Without hysteresis, the alarm might be unstable at the switching point (relay chattering) if the speed surpasses the setpoint slowly). The hysteresis bandwidth is set as a percentage of the setpoint.
P07.02 **Hysteresis position of SP4** Range: 0 .. 1	The hysteresis band may be placed above or below setpoint. "Above" means, the alarm goes to excess state (>), when the speed exceeds "set-point plus tolerance", and it cancels to no-excess (<), when the speed drops below setpoint. "Below" means, the alarm goes to excess (>), when the speed exceeds the setpoint, and it cancels to no-excess (<), when the speed drops below "set-point minus tolerance". Setting: 0 : hysteresis above SP4 (recommended when monitoring n < SP4) 1 : hysteresis below SP4 (recommended when monitoring n > SP4)
P07.03 **Relay state at ' n > SP4 '** Range: 0 .. 1	Without power supply, the alarm outputs are non-conducting, and the relays are de-energized. To consider safety aspects of the application, this No-Power condition can be assigned to either alarm > or < condition. Setting: 0 : relay de-energized at ' n < SP4 ' 1 : relay de-energized at ' n > SP4 '
P07.04 **Starter effective for SP4** Range: 0 .. 1	The starter function may be effective for each setpoint individually. Thereby it is possible, for instance, to disable a low speed alarm during the starter phase, whereas a high speed alarm remains active all the time. Setting: 0 : starter not effective for setpoint SP4 1 : starter effective for setpoint SP4
P07.05 **Relay state at starter condition** Range: 0 .. 1	At starter condition, the alarm may be forced to states ' n < SP4 ' or ' n > SP4' (if starter function is effective for the alarm). Setting: 0 : ' n < SP4 ' 1 : ' n > SP4 '
P07.06 **Forced state SP4 at** **sensor fault condition** Range: 0 .. 2	At sensor fault, the alarm may be forced to states ' n < SP4 ' or ' n > SP4'. Setting: 0 : no forced state, state acc. to measured speed 1 : state forced to ' n > SP4' 2 : state forced to ' n < SP4 '

Parameter Group P08.xx USB Data Interface	
Parameter No. **Meaning of Parameter** Setting Range of Parameter	**Description of Parameters and their Settings**
P08.00 **Baud rate** Range: 0 .. 4	Setting: 0 : 300 Baud 1 : 1200 Baud 2 : 9600 Baud 3 : 19200 Baud 4 : 38400 Baud
P08.01 **"my device" No (address)** Range: 001 .. 125	

5.1 Default Values at delivery

If not specified otherwise, the unit is supplied with default values as listed in the summary of parameters. In the process of installation, the setting of its parameters inevitably must be adapted to the correct values according to its application.

6 Installation

The unit is designed for snap-on track mounting according DIN 50022.
Dimensions see chapter 7.3. As a specific version, it can be supplied in a field mounting enclosure (appendix –G to model No.).

7 Safety Notes for Installation and Operation

7.1 Safety Notes for Installation

This unit has been designed and inspected according to standards DIN EN 61010-1. Observe these instructions and wiring diagrams carefully, to ensure this protection. The installation must be done only by adequately qualified personnel.

7.1.1 General Instructions

Do not open the instrument. Connections and all programming are done from outside. When removing it from its enclosure, however, for whatever reason, make sure that power is switched off.
The instrument may be installed in any position, but not in the immediate neighborhood of interfering sources.
Signal leads must be carefully shielded, and should not be run in bundles with power or relay control leads.

7.1.2 EMI

The unit complies with all relevant regulations, as determined by the Policy of the European Committee for Electrotechnical Standardization (CENELEC), for the Electromagnetic Compatibility (2014/30/EU). Testing and inspection have been performed according to Standards EN 61000-4-2 and EN 61000-4-4. Thereby, the product meets all requirements to be marked by the CE sign.

Strict observance of these instructions during installation and use is an indispensable precondition hereto.
Specifically, to be observed:
Terminals must be kept off all undue access; power supply and all input and output leads must be protected against voltage interference, higher than specified operation data, and they must be protected against electrostatic discharge.
The screen of A5S sensors has to be connected to the screen bar.

7.1.3 Safety Notes for Operation

On initial operation of the monitored machine, the operator must ensure proper function of the measurement chains. This includes checking of the correct speed display and the trip release due to a real overspeed condition.
The parameter settings must be documented and protected against unauthorized changes.

7.2 Safety Notes for SIL2 Speed applications in hazardous areas

7.2.1 Monitoring the Speed Signal

The barrier D461 monitors the current consumption of the sensor A5S1.. and will release an alarm in case of a fault. This provides an early warning, if a defective or non-connected sensor is detected.
The signal output of the D461 will be transferred via its alarm contacts to the measuring input of the D521 (see following diagram).

For full protection against overspeed, the speed signal must be monitored using a plausibility setpoint (checking for low speed).
This covers each possible signal fault (fault within the sensor, fault within the barrier, cable break or short circuit, wrong or incorrectly mounted sensor).
The plausibility setpoint must be set to approx. 30% of nominal speed to guarantee a fast reaction in case of a speed signal fault.

7.2.2 Use of alarms SP1 to SP4

SP1 to be used as Overspeed setpoint.
SP2 to be used as Low-Speed setpoint (30% of nominal speed).
SP3 to be used to signalize Standstill.
SP4 to be used as alarm Fault.

Note:
If only Low-Speed is monitored, SP1 to be used for Low-Speed setpoint.

7.2.3 Monitoring the Speed during operation

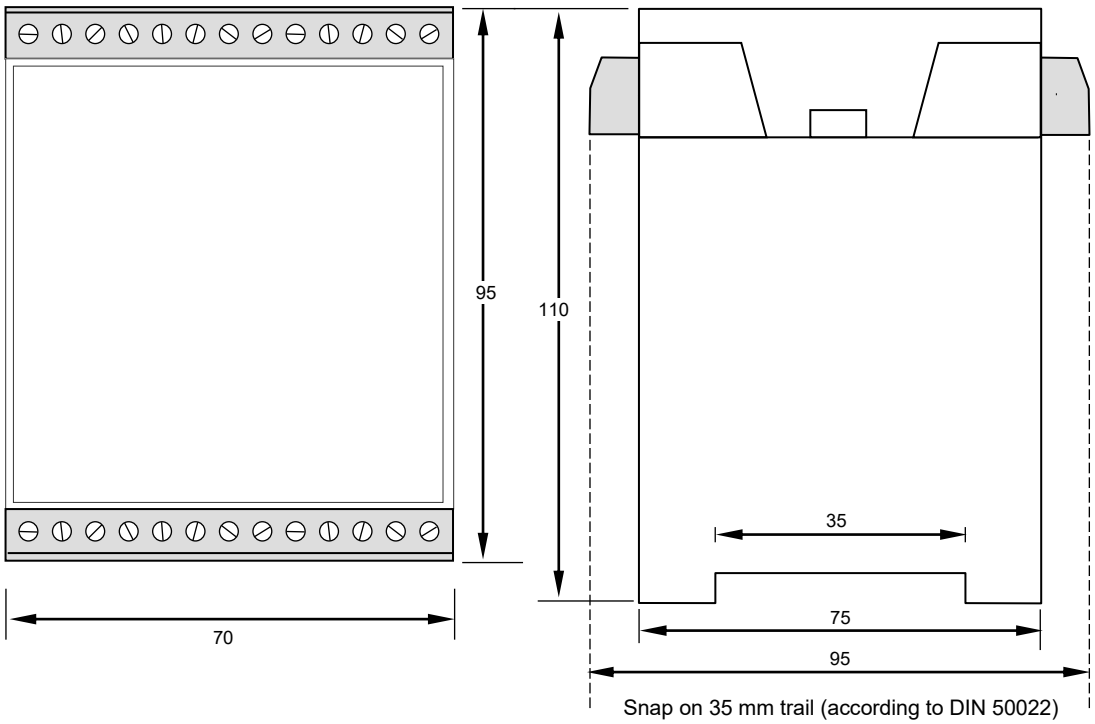
During normal operation of the machine, the measured speed must be in between SP1 and SP2. If SP1 (Overspeed) is exceeded or SP2 (Low-Speed) is underflown, the machine must be switched off.
If Fault is signalized, the machine must be switched off.
To speed up the machine from Standstill to normal speed, a Starter signal must be activated. This signal must be valid until the machine runs faster than the Low-Speed setpoint (30% of nominal speed).

7.2.4 Safety Notes for Standstill alarm SP3

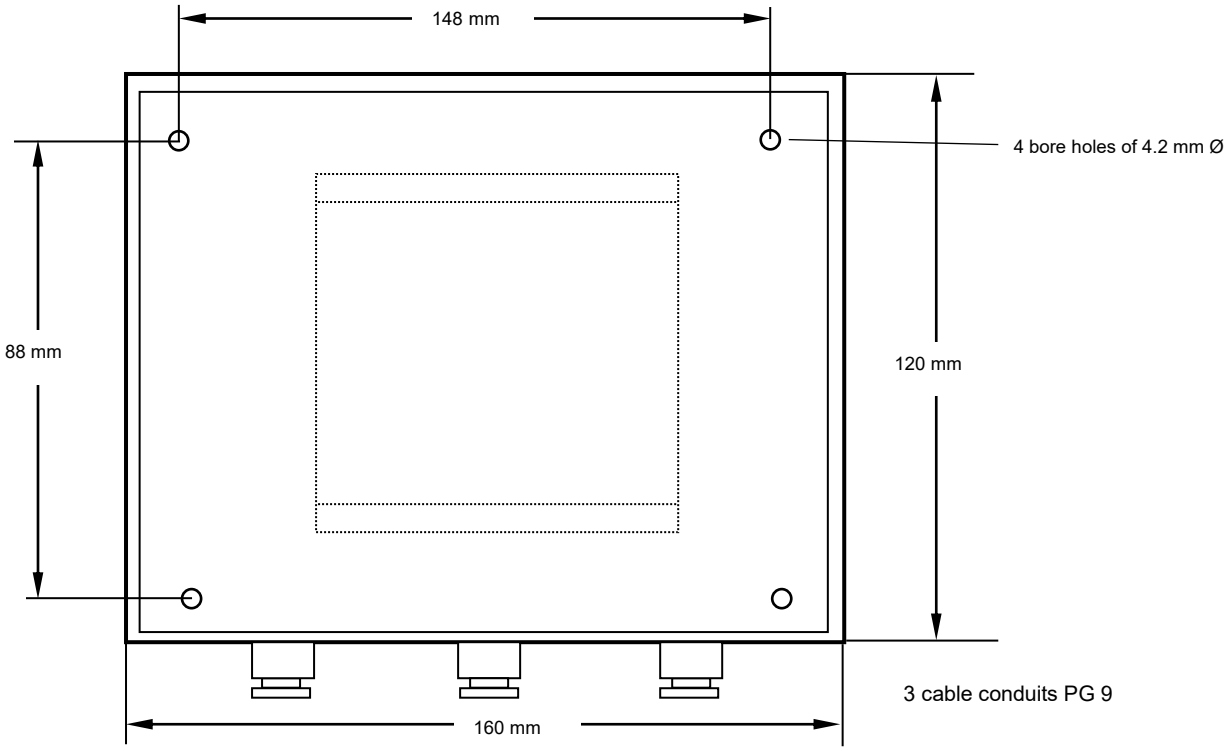
For safety applications, the alarm SP3 must be used in combination with an additional different criterion as plausibility check (e.g. "power off").

7.3 Dimensions

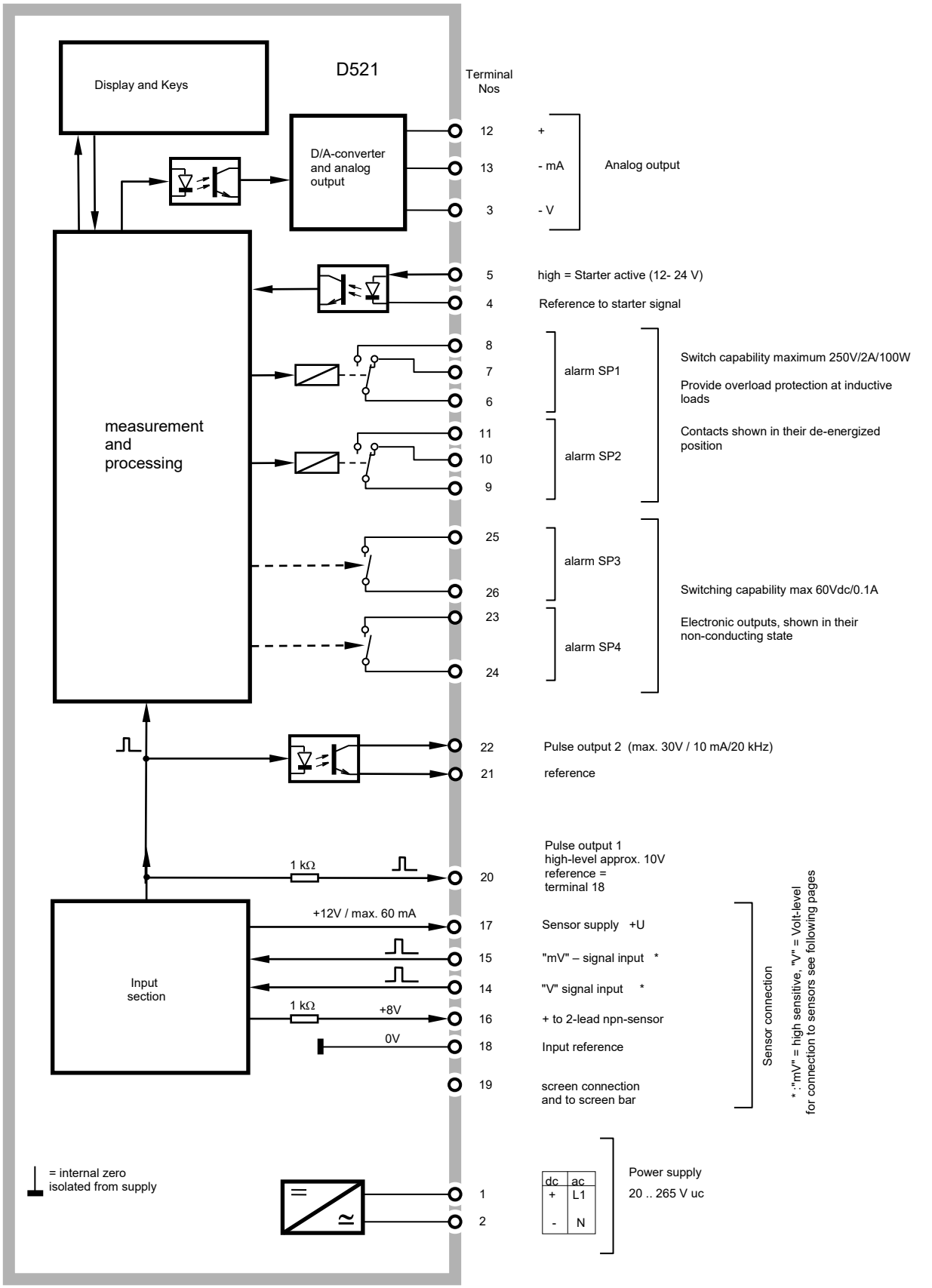
Dimensions (mm) of snap-on-track (standard) version



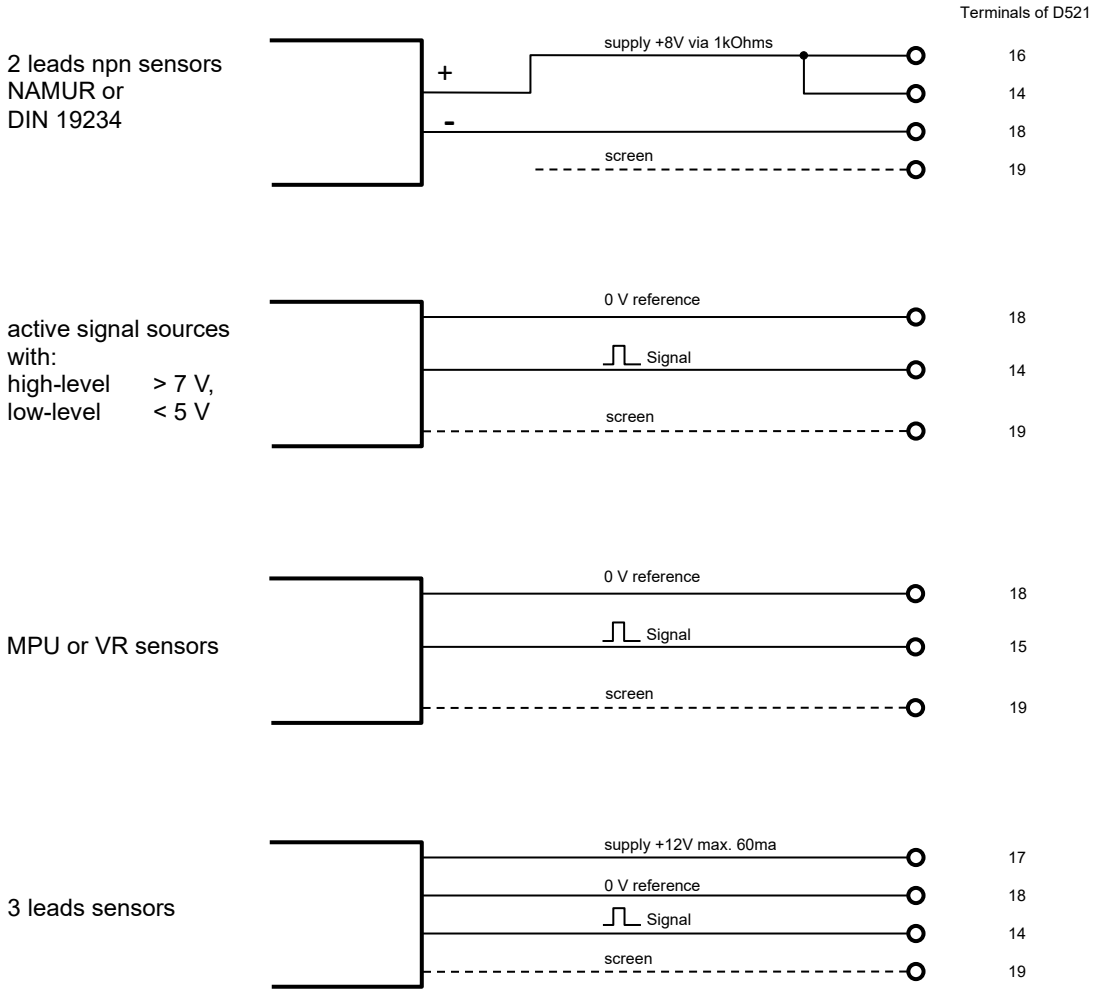
Dimensions of Field Mounting Enclosure (Option -G)



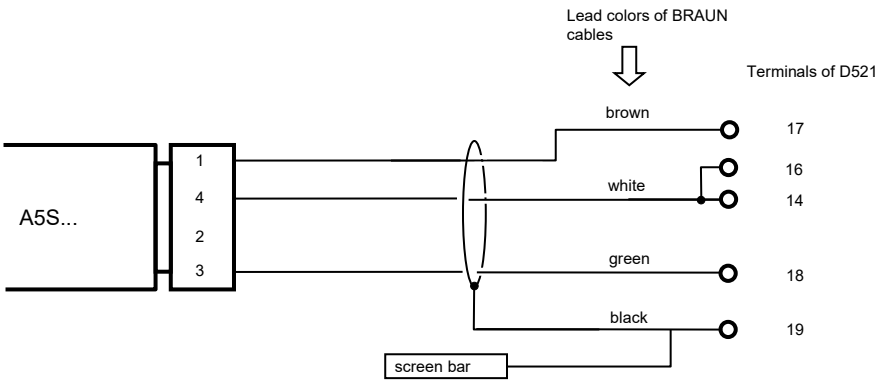
7.4 Function diagram and connections of D521



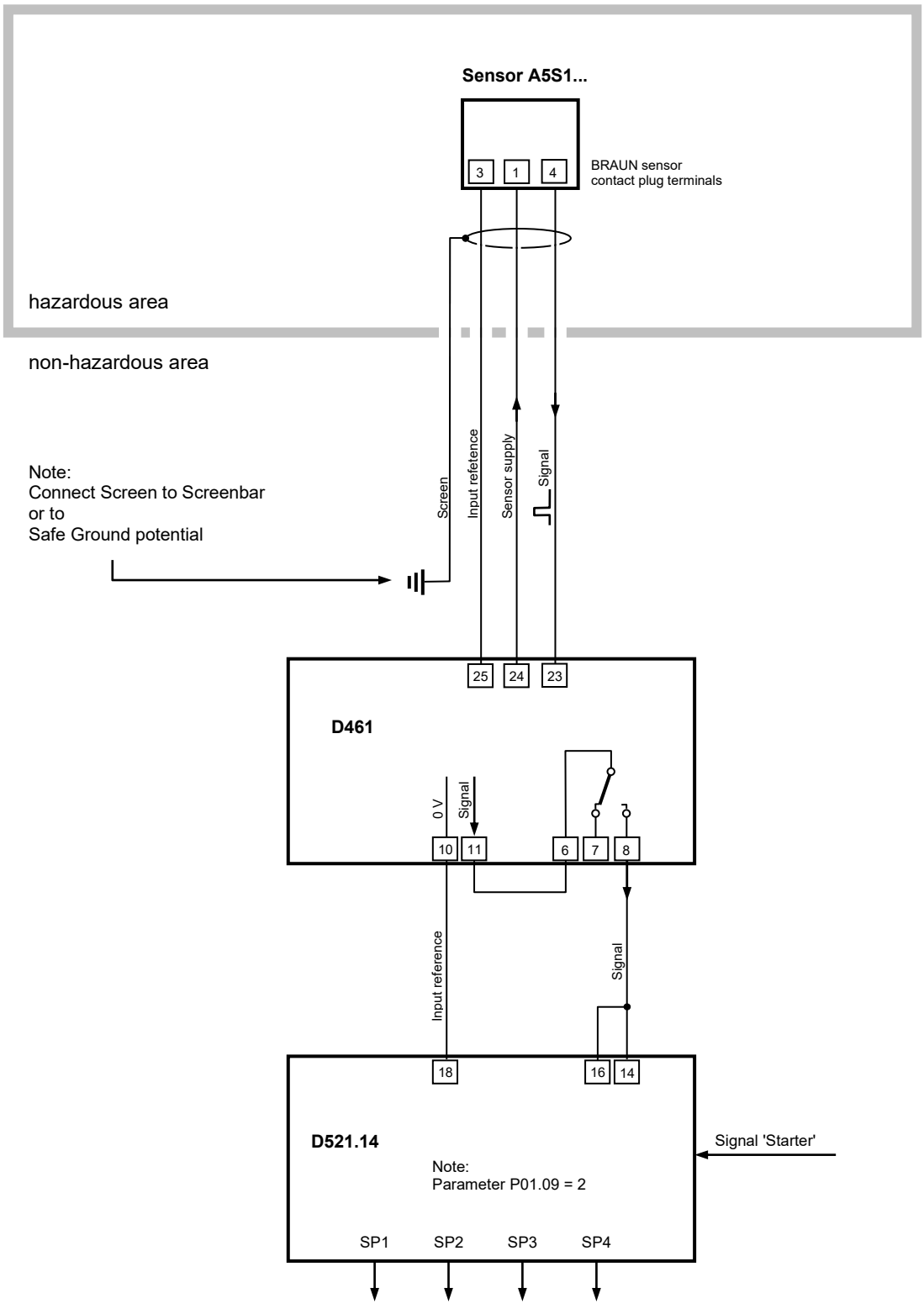
7.5 Connections of measuring signals to input



7.6 Connection of BRAUN A5S sensors



7.7 Connection of A5S1.. with D461 to D521



8 Safety Values

See document D521-SIL1-Manufacturer Declaration_Rev02

9 Revision notes

Date	Rev.	Modification
06.2008	01	Wiring Hall Effect-Sensors modified
06.2009	02	Pulse Output on terminal 20 obsolete
08.2009	03	Pulse Output on terminal 20 reintroduced
04.2011	03	SE-01 description included
10.2011	03	Maximum signal voltage for P01.09 = 2 or 3 limited to 30 V dc
08.12.2011	03	- Hysteresis location "symmetrical" (setting 2) cancelled - New document design
20.04.2012	03	Parameter P01.09 (sensor monitoring mode) with additional settings 4 and 5 (only effective for version D521.14)
28.08.2012	03	Terminals for SP3 and SP4 corrected (SP3 ↔ SP4 switched)
07.02.2013	03	Terminal nos of D521 in chapter 7.7 (wiring diagram for A5S1-D461-D521) corrected, chapter 7.2 modified.
06.05.2013	03	Function diagram: starter input formally inverted (just design)
22.05.2013	03	- Measurement Sequence description page 2: 5 msec – 9.999 sec - For Ex-Applications (with A5S1.. and D461) P01.09 must be set to 2.
28.02.2015	04	Latched alarm is reset by: Key E + Key ◅
28.03.2015	04	Function Diagram modified
01.12.2015	04	Change of directive 2004/108/EG to 2014/30/EU
21.01.2016	05	Note regarding Low Speed Monitoring added in chapter 7.2.2. Chapter 8 for Safety of Measuring Chain D521-A5S0 resp. D521-D461-A5S1 added
30.03.2016	06	Description of parameter P01.05 modified
26.05.2017	07	Change to Bookmark Format
04.12.2018	08	Suffix M for extended operational temperature included
24.10.2019	09	Programming Interface now USB 2.0 instead of RS232 Valid for D521 with serial nos exceeding 1910239999
14.07.2020	10	Switching capacity data for SPDT relays corrected Note on L3D07 and L3D08 inserted
07.07.2021	11	Connections of A1S3 sensors inserted
20.03.2023	12	Connections of MPU inserted in chapter 7.5
05.02.2025	13	Connections of obsolete A1S3 sensors removed

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FREQUENZ UND DREHZAHL

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