Operating Instruction

42/14-311 EN

Parameterizable transmitter for frequency and rotational speed ENM4

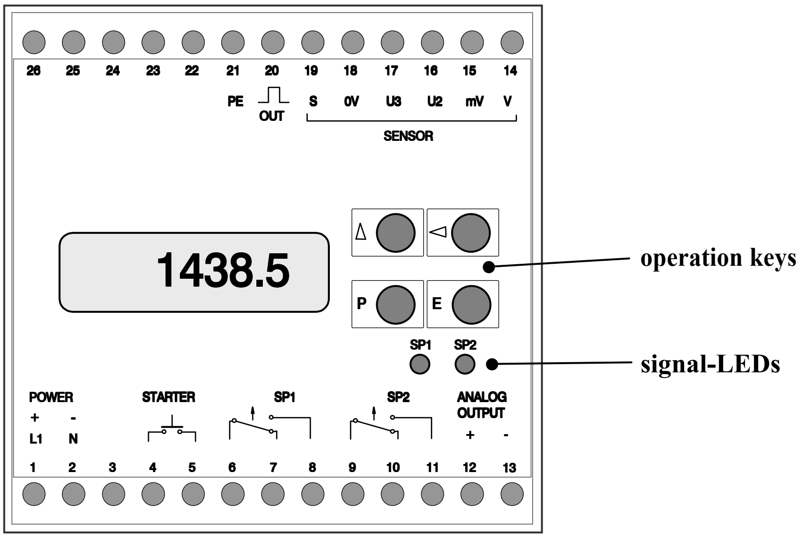
ABB

Contents **Page**

Specifications

Enclosure:	Snap-on Track according DIN 50022 (35mm rail), Dimensions.. 70x75x110 mm
Weight	.... approx. 0,4 kg
Allowable Ambient Temperature	Operation ....0°C..+50°C extended version (Option) .... -25 °C ... + 65 °C Storage and Transport . ... -40°C..+85°C
Protection Grades	Electrical Insulation ....I Voltage..I Environment: Standard... IP20 Field Enclosure (option) IP65
Power Supply	Voltage according to Model No .... 18....40 v uc or......... 85..265 v uc Power Consumption 5va
Signal Input	Response: "Volt-level"-path:................................ high at > 7v, low at < 6v “high sensitivity” path:.......................high at > 50 millivolts eff. Sensor Supply............................. 18v, max. 40ma and 8v via 1 kOhm Input impedance .... 100 kOhm Response time ....5 millisec - 100 sec (programmable)
Accuracy	± 0,01 % of measurement and/or ± 1 in least significant digit (LSD)
Analog Output	Standard ....0/4 to 20mamps Option: 0/2 to 10 v Resolution .... 12 bit max. load..750 ohms Linearity Error...< 0,1%
Alarms (Option)	relays .... 2 each with SPDT Voltage handling .... min 10mv, max. 250v ac/dc Current handling......................... min 10ua, max. 2amps AC, 1amp dc Power handling... max. 100w, 250va Inductive loads must have spark extinguishing!
Display	Reading ....LCD 8stellig Decimals.. programmable Range 0...99999

Display and Operation Elements



Short Form Instructions to Operation

Functions

The unit measures the frequency of the input signal, to convert it into the analog output, and (if provided) to the operation of 2 alarms. The display serves to assist at programming, and it reads the variable if not in the programming phase.

functions and options

Programming

For an easy and fast access, the entire program is structured into groups, each assigned to a specific functional range, and program steps for the specific parameter within the group. See scope of program steps.

Program Structure

Switch between operation and programming mode by key [P].
See page 7 for programming instructions.

Error Display:

-E1- : wrong access code figure, unauthorized access.

Error Display

Function Principle

Pulse distance measurement

The measurement evaluates the time interval between pulses of the frequency signal, which transmits the variable. The programmable minimum measurement period determines, how many of the input pulses are included into one evaluation. Obviously, this ensures the fastest response to the process signal. The result is computed from the precise time elapse, and the amount of pulses included into the evaluation period. It reads in programmable terms of the variable.

Accuracy:	± 0,01 % of measurements and/or ± 1 in LSD
Resolution of analog output	12 bit (1:4000)

Step down sequence

response to signal interrupt

If the input signal sequence cancels abruptly, the measurement steps down to zero, with its descent automatically adjusted by the most recent frequency level. At a programmable low end, it shuts off, eventually signalizing zero..

Signal Input (V)

V path input specs
(terminal 14)

Fits all signal sources which meet these characteristics:

Voltage on/off level >7/<6 volts.
Maximum voltage 100 volts.
Input impedance 100 kohms.
Frequency range 0... 20 kHz.

- NAMUR (DIN 19234) type sensors

current drain on/off 2,0 /1,2 mamps,
with load resistor 1 kohms.

Transmitter supply:

8 v (via 1 k load), and 18 v/40 mamps.

Signal Input (mV)

mvolts path input specs
(terminal 15)

Fits all AC-type signal sources, or such with superposed DC-voltage, or such missing the above V- on/off level.

Signal must have this minimum voltage (if sinusoidal):

500 mveff	between	0.1 Hz........1 Hz
50 mveff	between	1 Hz......10 kHz
500 mveff	between	10 kHz... 20 kHz.

Maximum voltage 100 v and ± 10 v superposed DC.
Input impedance approx.50 kohm.

Scaling and definition to the measurement performance

Definitions to Measurement

To adjust the unit to the signal provided by the application, a pair of parameters is programmed. It assigns a specific signal frequency to a desired corresponding value of the variable under measurement, including decimals of both. Further, an input pre-divider for the frequency can be programmed to compensate for periodic variations in the input signal sequence.
Also, a minimum measurement period must be defined.
The description of the parameter steps give further details.

Alarms (Option)

Alarm definitions

Two independent alarm circuits actuate output contacts (SPDT each). Level and characteristics of response are individually programmable to both. A starter function becomes active by a contact closure between terminals 4 and 5, and for a programmable period of time (up to 999 seconds) thereafter.

Analog Output

Programmable analog output

Current value 0/4 to 20 mamps into a load up to 750 Ohm. Linear relation to the measurement, with programmable span. Live zero programmable.
Voltage output as option only.
Resolution of conversion: 12 bit (1:4000).
Temperature drift: < 0,02 %/°C within 0...40°C.

Pulse Output

Square wave pulse output

Repeating the input sequence (undivided), shaped to square waveform. Output level approx. 15 volts with 1.5 k source impedance. Common zero to input.

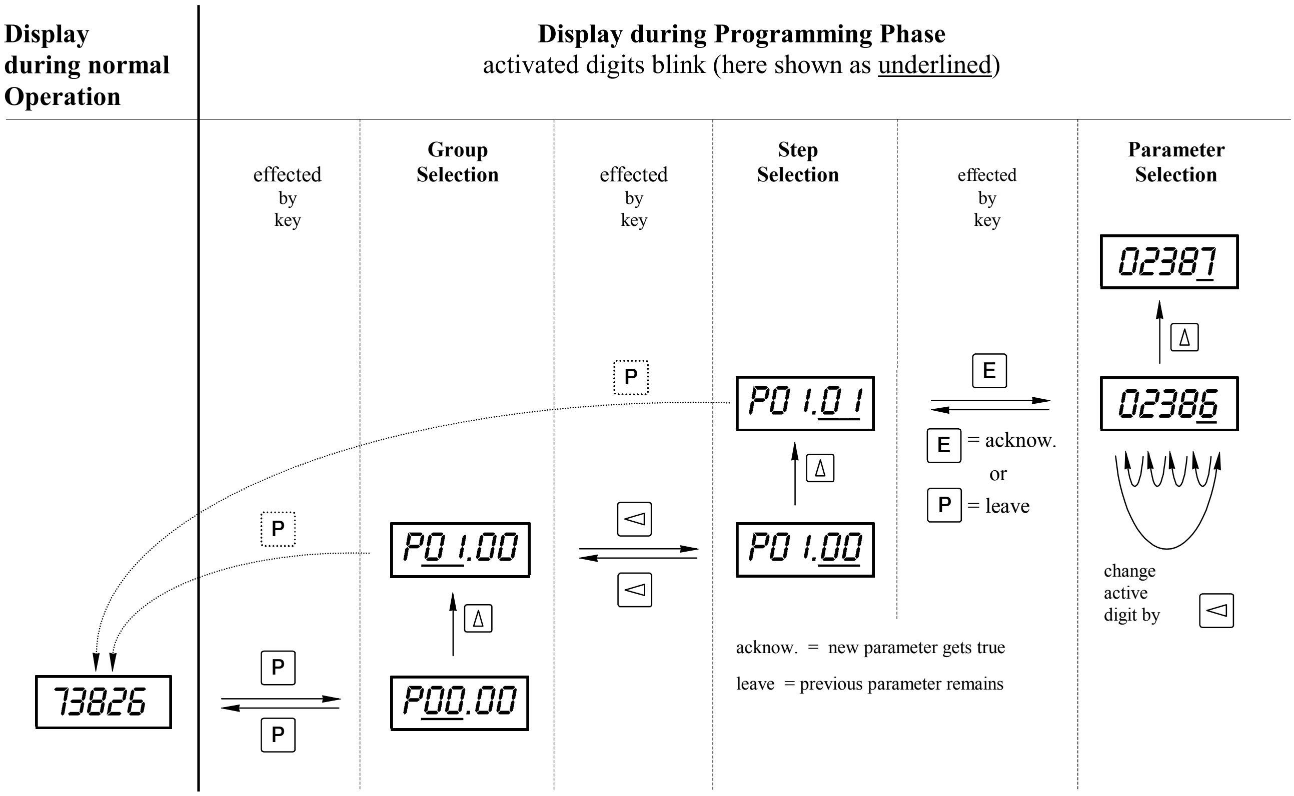
Short Form Instructions to Programming the Parameters

General: Approach to the parameter by selecting its „name“: **Pgg.ss**,
where **gg** = No. of Parameter-Group
ss = No. of step within the group

Then read and alter its value if required.

Procedure:
Start the programming phase by touching key [P]. The display now reads P00.00.
Select group No. by key [Δ] .
Switch to step No. (and reverse) by key [◁] . Select step No. by key [Δ] .
Touch key [E] to read the actual value of Parameter.
To modify, select digit by key [◁] .
Actuate key [Δ] to select desired value for the activated digit.
With all digits correct, acknowledge by key [E]. Or, touch key [P] to leave with the previous value.
Return to operation by key [P]

Example: Modification of P01.01 from value 2386 to value 2387



Summary of programming steps and their initial parameters as set on delivery

program- Step No.	comments on page	parameter function		data set on delivery (initial data)
P00 .00	9	access code request		0000
.01	9	new code figure		0000
.02	9	access status (1= unlocked, 0=locked)		1 = unlocked
P01 .00	9	scaling (high end values)	decimals of input signal frequency	0 = none
.01	9		value of nominal input frequency (Hz)	00100
.02	9		decimals of corresponding variable	0 = none
.03	9		corresponding variable (unit as desired)	00100
.04	9	low end of measuring range		00001
.05	10	minimum measuring period (00005...99999 millisec)		00030
.06	10	pre-divider adjustment (01...99)		01
P02 .00	10	starter phase time elapse for both setpoints (XXX sec)		000 (sec)
P03 .00	11	setpoint SP1	setpoint (SP1) in terms as programmed by scaling	10000
.01	11		hysteresis bandwidth (XX % of SP1)	05 (%)
.02	11		hysteresis location (0=above, 1=below, 2=symm)	1 = below SP
.03	11		alarm status assigned to "no-power" (0=<, 1=>)	1 = > SP
.04	11		starter function effective for SP1 (0=not, 1=yes)	1 = effective
.05	11		alarm status during starter phase (0=<, 1=>)	1 = > SP
P04 .00	11	setpoint SP2	setpoint in terms as programmed by scaling	01000
.01	11		hysteresis bandwidth (XX % of SP2)	05 (%)
.02	11		hysteresis location (0=above, 1=below, 2=symm)	1 = below SP
.03	11		alarm status assigned to "no-power" (0=<, 1=>)	1 = > SP
.04	11		starter function effective for SP2 (0=not, 1=yes)	1 = effective
.05	11		alarm status during starter phase (0=<, 1=>)	1 = > SP
P05 .00	12	analog output	low end of conversion range (terms as scaled)	00000
01	12		output zero level (0 = dead zero, 1 = live zero)	1 = live zero

Note: Program Groups P02..., P03…, P04…are irrelevant without the alarms option, may be skipped in programming.

Initial Data
The unit comes programmed to these initial parameters, if not ordered otherwise, as a specific option. In course of the installation however, adjustment to the specific application conditions is indispensable.

Programmable Parameters

See page 8 for the summary of program steps, and page 7 for the short form programming instructions

Group P00.xx
Data Access and Minimum Measuring Period

Code figure to access

Step P00.00
Code figure to access

Programming access to all parameters can be locked by a password number. If not properly served, the parameters may be called to display but not varied. If not properly served, the display reads -E1-,and any programming in a later program step will be rejected.

Step P00.01
new code figure

Note:
If the knowledge of the password number went lost it may be recalled to display by a procedure, as described in a separate sheet K0-095 (not included into these instructions). In a subsequent program step, a new code may be established, substituting the one previously valid.

Step P00.02
unlock access key

The code function may be disengaged by a next program step. With authorized access, set parameter to 1 in step No .02, to generally unlock the key. This may prove practical during the installation phase to facilitate the adjustments. Once installed, the key function should be re- activated, by programming parameter 0 in this step.

Group P01.xx
Scaling and Definition of the Measurement Performance

Input Scaling

Step P01.00
decimals for input frequency

Step P01.01
signal frequency at reference

Step P01.02
decimals for display

Step P01.03
value of the variable at reference

Scaling defines the relation between the input signal frequency (in terms of Hz), and the corresponding process variable (in the unit term and decimal position as required by the application), as it exists at the high end of the intended operating range. Both values are free programmable by their decimals and numerical amount. Of course, they must refer to the same operation level.

Example:
A signal frequency of 435.42 Hz corresponds to a linear speed of 8.215 m/min.

Program as follows:	*in step P01.00*	*parameter 2*
	in step P01.01	*parameter 435.42*
	in step P01.02	*parameter 3*
	in step P01.03	*parameter 8.215*

Notes:
The level thus selected simultaneously defines the high end of the analog output (20 ma).

Do not use too many decimals! If there are more decimals than justified by the operational fluctuation of the variable, and the transmitter resolution, the measurements will fluctuate accordingly.

Low end level

Step P01.04
Low end definition

The parameter of this step defines the low end of active measurement, by the same terms as selected for the high end in the previous steps P01.02 and .03. When the speed is below this level, the measurement will be set to zero, in display, analog output, and alarm condition.

Minimum Measuring Period

Step P01.05
Minimum measuring period

The measurement is based on a time interval measurement over a (variable) number of input signal pulses. However, the programming allows to define a minimum time elapse for the measuring period. It 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 millisec 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 parameter of P01.05 defines the minimum measuring period of time, in terms of milliseconds, within a range of 00005....99999 millisec. A setting less than 00005 will be ignored.

Input Pre Divider

Step P01.06
Input Pre-Divider

The measuring principle, as explained in the corresponding chapter, calls for an optimum in repeatability in its pulse sequence, or in other words, equal pulse distance at a constant variable. This may be violated by an irregular profile at a speed measurement, or by the typical periodical pulse distance variation during the cycle of an oval gear flowmeter. The input pre-divider helps to balance this out, when set to the number of pulses included into one period of the fluctuation. It thus reduces the input pulse sequence to 1 pulse per period (= 1 pulse per 1 cycle of the movement).
Set the parameter of P01.06 to this figure (range 01..99).

With a regular input sequence however, use 001 for this parameter.

Note:
The value of the input frequency, as used in program step P01.01, refers to the actual input frequency, *divided* by the pre-divider setting.

Group P02.xx
Starter Function

Significant only with Alarm option installed

The starter function throws both alarm outputs to a defined condition, overriding the actual measurement. Which condition, and their activation at all, can be programmed in later steps (see Program Groups P03.xx and P04.xx), individually for both setpoints, whereas Program Step P02.00 defines the starter time elapse.

Starter phase time elapse

Step P02.00
Starter time elapse

The starter time elapse is set as the parameter of program step P02.00 within the range 000...999 (sec). The programmed time is valid for both setpoints SP1 and SP2

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ABB

Program Groups P03.xx and P04.xx

Defining the Performance of alarm setpoints SP1 and SP2

Significant only with Alarm option installed

The performance of each setpoint is defined by:

Alarm Level within the measuring range.

Step P03.00 / P04,00
Level of Setpoint SP1 / SP2

The setpoint response level is programmed by the same terms as selected for the variable under P01.02, P01.03.

Its hysteresis by bandwidth and location.

Step P03.01 / P04.01
Alarm hysteresis bandwidth of SP1 / SP2

The hysteresis is the margin between condition "excess" (>) and "no excess" (<), defined by its bandwidth and its position in reference to the setpoint.

The hysteresis bandwidth is set as the parameter of the corresponding program step, as a percentage of the setpoint, within the range of 01..99 (%).

Step P03.02 / P04.02
Hysteresis location of SP1 / SP2

The hysteresis band may be located above setpoint, below setpoint, or symmetrically around the setpoint.
"Above" means, the alarm goes to excess state (>) when the speed exceeds the setpoint plus tolerance bandwidth, and it returns to no-excess (<), when the variable drops below setpoint. Set parameter 0 for this performance.
"Below" means, the alarm goes to excess (>) when the variable exceeds the setpoint, and it cancels to no-excess (<), when the variable drops below setpoint minus tolerance. Set parameter to 1 for this performance.
In "symmetrical" mode, the alarm goes to > when the variable exceeds the setpoint by half the tolerance band, and it cancels to < at half the tolerance below setpoint.
Set parameter to 2 for this performance.

Alarms condition assigned to “no power”.

Step P03.03 / P04.03
No-Power condition of SP1 / SP2

Without power supply to the unit, the alarm relay is de-energized (as shown in the Function Diagram). To consider safety aspects of the application, this No-Power condition can be assigned to either alarm > or < condition, by a corresponding parameter selection in this step:
0 = < setpoint
1 = > setpoint

Alarms condition during the starter phase.

Step P03.04 / P04.04
SP1 SP2 included or not into the Starter Function

The starter function is explained under Program Group P02. The corresponding parameters of Program Groups P03 and P04 define the individual performance of each alarm during this phase.
One program step defines, individually for each alarm, whether or not it is included into the starter function. 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.
In the corresponding program step, set
Parameter = 0, to exclude the alarm from the starter function,
parameter = 1, to include the alarm into the starter function

Step P03.05 / P04.05
Starter condition of SP1 / SP2

A further program step defines, individually for each alarm, which condition it will take (if included into) during the starter function. Set
Parameter = 0 to throw the alarm to < setpoint,
parameter = 1 to throw the alarm to > setpoint.

Program Group P05.xx
Analog output

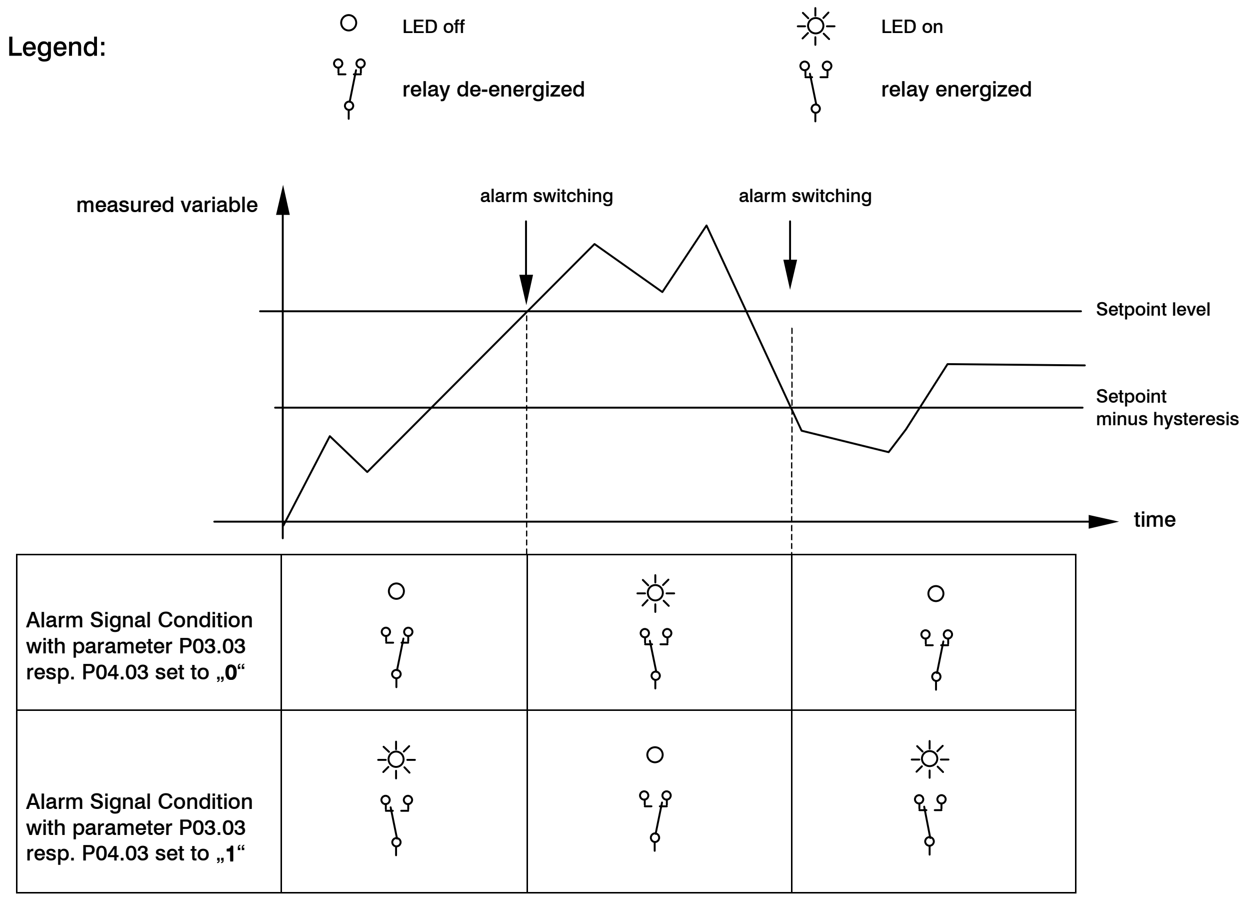
Step P05.00
Low end of the analog output

High and low end of analog output span
The high end of the analog output equals the high end of the operating range as defined by program step P01.03. The low end of the analog output is assigned to a selectable value of the variable by program step P05.00:
It is set by the same terms as already defined for the variable by program steps P01.02 and P01.03.
Note:
This allows the low end to be set as high as 90 % of the high end, resulting in a 10 times spreading (enhancement) of the converted band. Further enhancement is not recommended.

Step P05.01
Analog output level at its low end

Analog output zero level
The parameter of step P03.02 defines:
0: without live zero (band 0...20 ma = low...high end),
1: with live zero (band 4...20 ma = low...high end).

Example to Alarm Performance with hysteresis below setpoint



Installation

Mounting

The unit snaps on a standard DIN rail of 35 mm width.

Instructions for mounting

If a screw mounting is required, follow this procedure: Insert a small screw-driver blade under the clover-leaf sized flap of the black bottom strip, and lift the flap over the small gray projection in the enclosure. Remove the black strip, now loose, to mount it, flat side down, at the desired place. Then slip the enclosure over the fixed strip.

The unit can be operated in any position, but the General Instructions must be observed. Avoid the neighborhood of interfering sources.

For allowable ambient operating conditions see “Specifications”.

General Information to Mounting and Wiring

This instrument has been designed and inspected according to standards DIN 57 411 / VDE 0411Sect 1, and IEC 348. Observe these instructions and wiring diagrams carefully, to ensure this protection. The installation must only be done by adequately qualified personnel.

General Instructions for wiring

Specifically, connect the ground terminal (PE) of the instrument to a safe ground potential.

Do not open the instrument. Connections and adjustments are done from outside. When removing it from its enclosure however, for whatever reason, make sure that power is switched off.

All connections are made to terminals placed underneath the top, with access from the side. Wire or stranded wire can be used, up to 1.5 mm^2.

Signal leads must be carefully shielded, and should not be run in bundles with power or relay control wires. Cable screens are to be connected immediately to a reliable ground potential.

EMI/CE

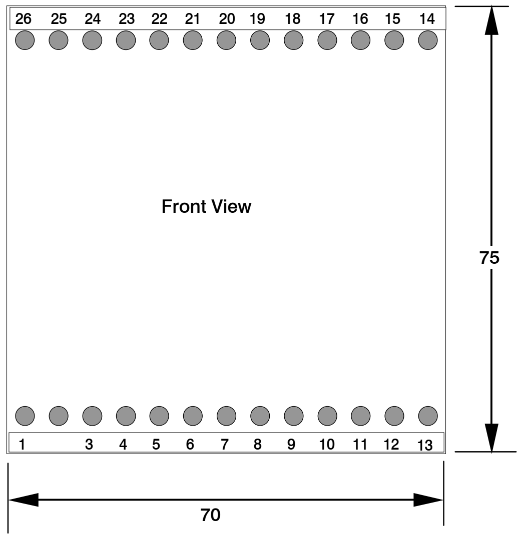
The unit complies with all relevant regulations, as determined by the Policy of the European Committee for Electrotechnical Standardization (CENELEC), for the Electromagnetic Compatibility (89/336/EWG). Testing and inspection has been performed according to Standards DIN-EN 50081-2 and DIN-EN 50082-2 with status November 1994. Thereby, the product meets all requirements to be marked by the CE sign.

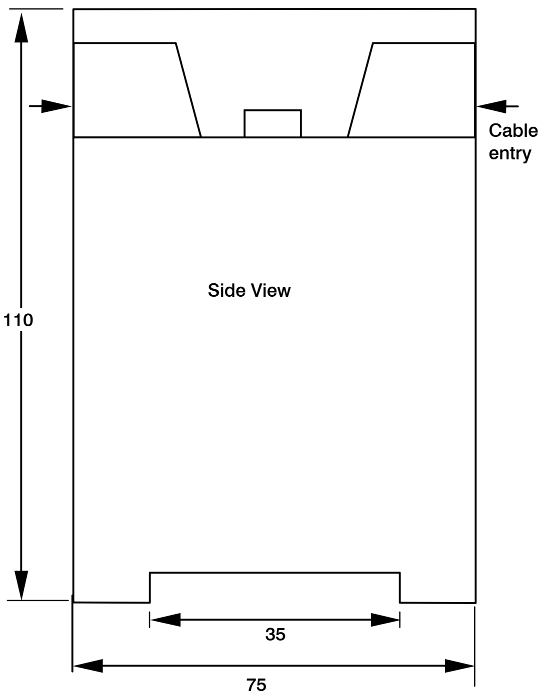
Notes concerning Electromagnetic Compatibility

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.

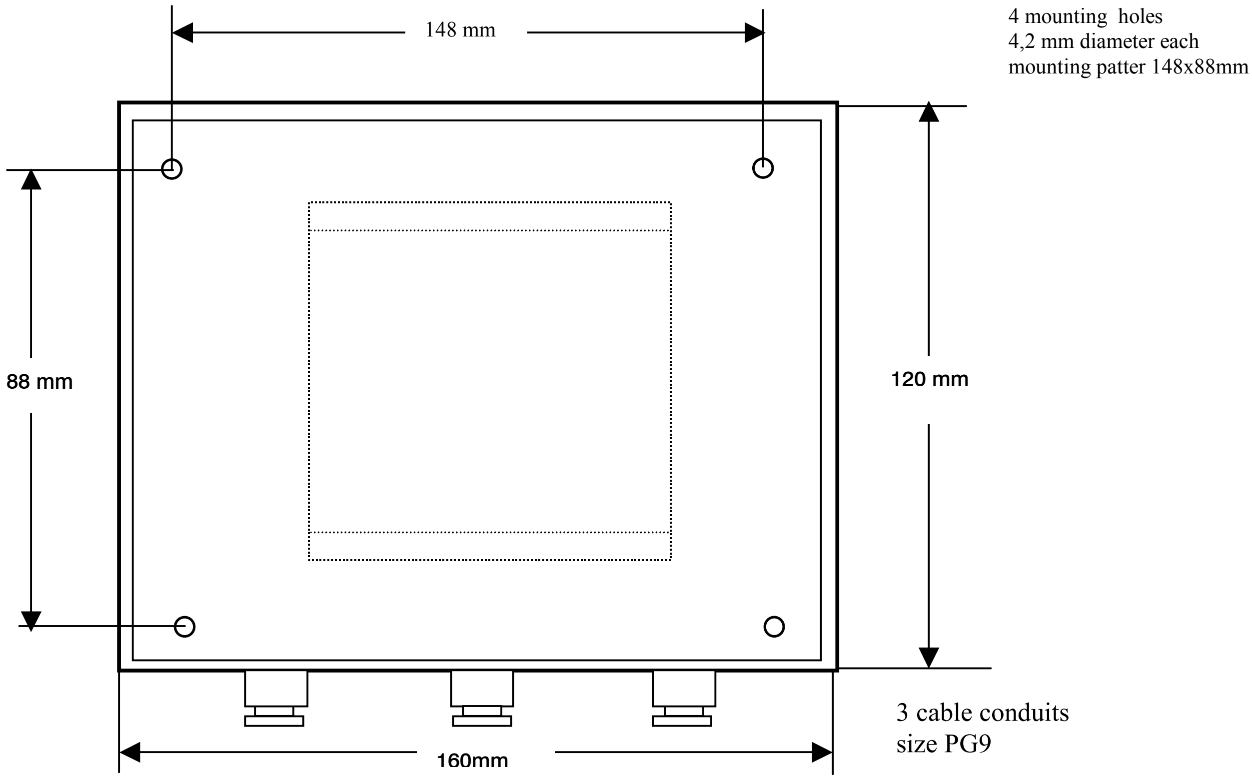
Dimensions of the Standard Snap on Track Version (by mm)





Mounting by snap on 35 mm rail
DIN 50022

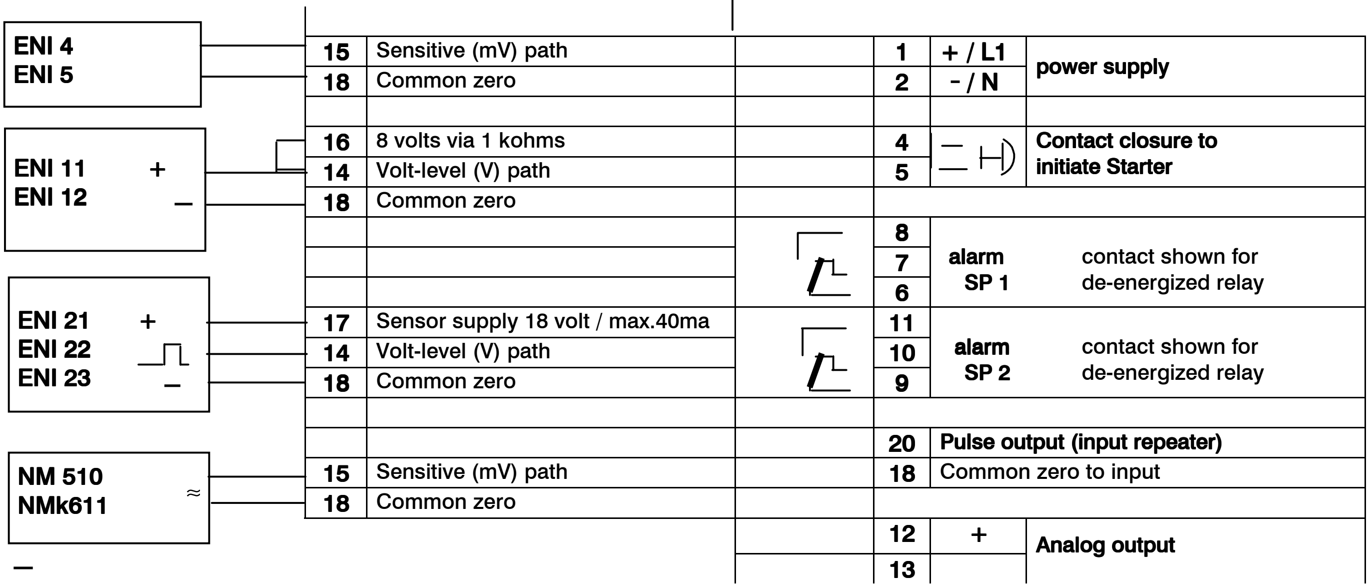
Dimensions of the (optional) Field Enclosure



Wiring Diagram

Connecting various transmitters to the signal input

Function Connections



Connect cable shield without immediately to ground potential.

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