



H250 M40 Supplementary Instructions

Equipment protection level EPL Gb and Db
Equipment protection by intrinsic safety "i"
Equipment protection by constructional safety "c"



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1.1 General notes

These additional instructions apply to explosion-protected versions of variable area flowmeter with electrical built-ins in type of protection intrinsic safety "i" and without electrical built-ins in type of protection constructional safety "c", equipment protection level (EPL) Gb and Db. They complete the standard manual for the non-explosion protected versions.

The information given in these instructions contains only the data relevant to explosion protection.

The technical details given in the standard manual for the non-explosion protected versions apply unchanged unless excluded or superseded by these supplementary instructions.

1.2 TR CU conformity

Conformity of the variable area flowmeter for use in hazardous areas was tested in accordance with the Custom Union Technical Regulation TR CU 012/2011.

The number of the certificate is:

TC RU C-DE.ГБ04.B.00713

1.3 Safety instructions

If these instructions are not followed, there is a risk of explosion.

Assembly, installation, start-up and maintenance may only be performed by personnel trained in explosion protection!



CAUTION!

The operator or his agent is responsible for observing any additional standards, directives or laws if required due to operating conditions or place of installation.

This applies in particular to the use of easily detachable process connections when measuring flammable media.



CAUTION!

When an equipment fault is detected the device shall be de-energised and send back to the manufacturer for repair.

2.1 Device description

Variable area flowmeters measure and display the volume flow of flammable and non-flammable gases and liquids. Depending on the device version, electrical limit switch contacts and a 4...20 mA signal output with HART® communication, a Foundation Fieldbus interface or a Profibus PA interface can be installed in the indication unit.

2.2 Description code

The safety description code consists of the following elements *:

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|--|---|---|---|---|---|---|--|--|
| H | 2 | 5 | 0 | / | | / | | / | M | 4 | 0 | / | | / | | / | | - | E | x | - | | |
| ① | | | | | ② | | | | ③ | | | | ④ | | | | ⑤ | | | | ⑥ | | |

Figure 2-1: Safety description code

- ① **Type series of measuring unit H250**
 H250 - standard version, vertical upwards
 H250H - horizontal orientation
 H250U - vertical downwards
- ② **Measuring unit materials / versions**
 RR - Stainless steel
 C - PTFE or PTFE/ceramics
 HC - Hastelloy C
 Ti - Titanium
 F - Food
- ③ **Heating jacket version**
 blank - without heating jacket
 B - with heating jacket
- ④ **Signal converter version**
 M40 - aluminium housing, painted (standard)
 M40S - aluminium housing with increased corrosion protection
 M40R - stainless steel housing
- ⑤ **High-temperature version**
 blank - without HT extension
 HT - with HT extension
- ⑥ **Electrical signal output**
 blank - without transmitter
 ESK - electrical signal output 4...20 mA (ESK4)
 ... - optionally available with counter, I/O module and display (ESK4-T) or
 ... - Foundation Fieldbus (ESK4-FF) or
 ... - Profibus PA (ESK4-PA)
- ⑦ **Limit switches**
 blank - without limit switches
 K1 - one limit switch
 K2 - two limit switches
 R1 - 1 Reed switch
 R2 - 2 Reed switches
- ⑧ **Version**
 Ex - explosion-protected version
- ⑨ **SIL version**
 SE - SIL compliant electronic signal output
 SK - SIL compliant limit switch

* positions which are not needed are omitted (no blank positions)

2.3 Marking

The marking of the entire device is clearly visible on the indication unit, in accordance with the designation code.

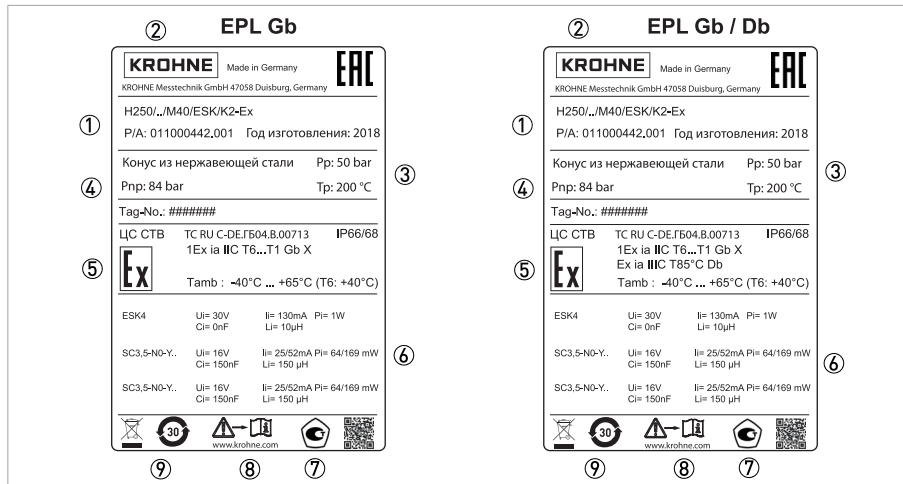


Figure 2-2: Example of a nameplate

- ① Device designation
- ② Manufacturer and manufacturer address
- ③ Rating data: temperature & pressure rating
- ④ Pressure data
- ⑤ Ex data according to notified body
- ⑥ Electrical connection data (depending on built-in equipment)
- ⑦ Symbol for region [e.g. Russia]
- ⑧ Internet address of the manufacturer
- ⑨ Safety instructions, disposal and data matrix

Additional markings on the housing cover:

- SN - serial number
- SO - sales order / item
- PA - production order
- Vxxx - product configurator code
- AC - article code

Additional plate

The association of the housing cover to the device is confirmed by an additional plate with the serial number on the interior of the indicator part.

2.4 Flammable products

Atmospheric conditions:

The standard atmospheric conditions under which it may be assumed that Ex equipment can be operated are:

- Temperature: -20...+60°C / -4...+140°F
- Pressure: 80...110 kPa (0.8...1.1 bar) / 11.6...15.9 psi
- Air with normal oxygen content, typically 21%v/v

Ex equipment operating outside the standard temperature range must be tested and certified (e.g. for ambient temperature range -40...+65°C / -40...+149°F).

Ex equipment operating outside the standard atmospheric pressure range and standard oxygen content is not permitted.

Operating conditions:

The measuring unit of variable area flowmeters operate outside the standard atmospheric pressure range, which means that explosion protection, regardless of the zone assignment, is fundamentally not applicable for the measuring unit (piping).



WARNING!

Operation with flammable products is only permitted as long as no explosive fuel/air mixture builds up inside of the piping at the same time the atmospheric conditions are exceeded.

The operator is responsible to ensure that the flowmeter is operated safely in terms of the temperature and pressure of the products used. In case of operation with flammable products the measuring units must be included in the periodic pressure tests of the piping.

When using the device version H250/C... (PTFE version, non-conductive) the minimum conductivity of the media must be 10^{-8} S/m, in order to avoid danger from electrostatic charge.

2.5 Types of protection

The variable area flowmeter type H250/M40 with electrical built-ins is designed in type of protection intrinsic safety "i" according to GOST 31610.11-2014 / IEC 60079-11:2011.

Type H250/M40 without electrical built-ins is designed in type of protection constructional safety "c" according to GOST 31441.5-2011 / ISO IEC 80079-37.

The marking for equipment **EPL Gb with electrical built-ins** is:

1Ex ia IIC T6...T1 Gb X

| The marking contains the following information: | |
|---|---|
| 1 | Gas explosion protection for zone 1 |
| Ex ia | Explosion protection through intrinsic safety, level of protection "ia" |
| IIC | Gas group, suitable for gas groups IIC, IIB and IIA |
| T6...T1 | Temperature class range, suitable for temperature classes T6...T1 |
| Gb | EPL, suitable for zone 1 |
| X | Indication of special conditions for safe use |

Table 2-1: Identification for equipment EPL Gb with electrical built-ins



INFORMATION!

For the equipment EPL Gb, connection to an intrinsically safe circuit with protection level "ib" is required.

When connecting the variable area flowmeter to an intrinsically safe circuit with protection level "ia", a higher protection level is given.

The additional marking of the version for the equipment EPL Db is:

Ex ia IIIC T85°C Db

| The marking contains the following information: | |
|---|---|
| Ex ia | Explosion protection through intrinsic safety, level of protection "ia" |
| IIIC | Dust group, suitable for groups IIIC, IIIB and IIIA |
| T85°C | Maximum surface temperature at 65°C ambient temperature |
| Db | EPL, suitable for zone 21 |

Table 2-2: Identification for equipment EPL Db with electrical built-ins



INFORMATION!

For the equipment EPL Db, connection to an intrinsically safe circuit with level of protection "ib" is required.

When connecting the variable area flowmeter to an intrinsically safe circuit with level of protection "ia", a higher protection level is given.

The marking for equipment **EPL Gb without electrical built-ins** is:
II Gb c IIC T6...T1 X

| The marking contains the following information: | |
|---|---|
| II | Equipment group, suitable for gas areas |
| Gb | EPL, suitable for zone 1 and zone 2 |
| c | Explosion protection through constructional safety "c" |
| IIC | Gas group, suitable for gas groups IIC, IIB and IIA |
| T6...T1 | Temperature class range, suitable for temperature classes T6...T1 |
| X | Indication of special conditions for safe use |

Table 2-3: Identification for equipment EPL Gb without electrical built-ins

The marking for equipment **EPL Db without electrical built-ins** is:
III Db c T70°C...T300°C X

| The marking contains the following information: | |
|---|---|
| III | Equipment group, suitable for dust areas |
| Db | EPL, suitable for zone 21 and zone 22 |
| c | Explosion protection by constructional safety "c" |
| T70°C...T300°C | Maximum surface temperature range |
| X | Indication of special conditions for safe use |

Table 2-4: Identification for equipment EPL Db without electrical built-ins

2.6 Ambient temperature / temperature classes

Due to the influence of the product temperature, variable area flowmeters with built-in electrical equipment (electric variants) are not assigned to any fixed temperature class. The temperature class of these devices is rather a function of the product temperature and ambient temperature that is present and the specific device version. The classification is outlined in the following tables.

The tables take into account the following parameters:

- Built-in equipment
- Maximum values I_i and P_i for K1, K2
- Ambient temperature T_{amb}
- Product temperature T_m
- Nominal size DN
- Standard or high temperature version (HT)
- Standard or heating jacket version
- Heat resistance of the connecting cable

When using more than one installed equipment, the data of the most unfavourable equipment should be used.



INFORMATION!

The maximum permissible product temperatures listed in the tables are valid under the following conditions:

- *The measuring device is installed and operated in accordance with the manufacturer's installation instructions.*
- *It must be ensured that the flowmeter is not heated by the effects of additional heat radiation (sunshine, neighbouring system components) and thus operated above the permissible ambient temperature range.*
- *Insulation must be limited to the piping. Unobstructed ventilation of the indicator part must be ensured. For this purpose, the variant with a projecting indicator (HT version) is preferable.*
- *For device versions with a heating jacket the temperature of the heating medium does not exceed the maximum permissible product temperature.*

For certain device versions, lower values apply due to differing boundary conditions (e.g. liner materials). Here the user should consult the technical data sheet.

Using a heat-resistant connecting cable

| Heating jacket | | | T_m ① | | |
|------------------|------------|------------|-------------------|-------------------|-------------------|
| without | with | HT version | $T_{amb} \leq 40$ | $T_{amb} \leq 60$ | $T_{amb} \leq 65$ |
| DN15, DN25, DN50 | DN15, DN25 | | 220 | 105 | 75 |
| | | x | - | 175 | 95 |
| DN80, DN100 | DN50, DN80 | | 165 | 90 | 75 |
| | | x | - | 155 | 90 |

Table 2-5: Temperature table in °C

① Maximum value of the product temperature for the use of a standard connecting cable. For higher product temperatures a connecting cable with a temperature resistance of 90°C is required.

| Heating jacket | | | T_m ① | | |
|------------------|------------|------------|--------------------|--------------------|--------------------|
| without | with | HT version | $T_{amb} \leq 104$ | $T_{amb} \leq 140$ | $T_{amb} \leq 149$ |
| DN15, DN25, DN50 | DN15, DN25 | | 428 | 221 | 167 |
| | | x | - | 347 | 203 |
| DN80, DN100 | DN50, DN80 | | 329 | 194 | 167 |
| | | x | - | 311 | 194 |

Table 2-6: Temperature table in °F

① Maximum value of the product temperature for the use of a standard connecting cable. For higher product temperatures a connecting cable with a temperature resistance of 194°F is required.

- HT version - high-temperature version with projecting indicator
- The permissible ambient temperature range is indicated on the nameplate; depending on the device version it is $T_{amb} = -40...+65^\circ\text{C}$ / $-40...+149^\circ\text{F}$ or $T_{amb} = -25...+65^\circ\text{C}$ / $-13...+149^\circ\text{F}$.
- The minimum product temperature is -40°C / -40°F .

| | | | | Maximum permissible product temperature T _m [°C] | | | | | | | | | | |
|---|--------------|------------|-------------------------|---|------|----------|------|------|------|------|------|--------|------|------|
| Heating jacket | | | TK ▶ | T6 | T5 | | T4 | | T3 | | | T2, T1 | | |
| without | with | HT version | T _{amb} [°C] ▶ | ≤ 40 | ≤ 60 | ≤ 65 | ≤ 60 | ≤ 65 | ≤ 40 | ≤ 60 | ≤ 65 | ≤ 40 | ≤ 60 | ≤ 65 |
| ESK4 | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | | | 85 | 100 | 90 | 135 | 135 | 200 | 160 | 140 | 235 | 160 | 140 |
| | | x | | 85 | 100 | 100 | 135 | 135 | 200 | 200 | 200 | 300 | 300 | 270 |
| DN80 DN100 | DN50 DN80 | | | 85 | 100 | 85 | 135 | 130 | 200 | 150 | 130 | 220 | 150 | 130 |
| | | x | | 85 | 100 | 100 | 135 | 135 | 200 | 200 | 200 | 300 | 300 | 255 |
| ESK4-T | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | | | 85 | 90 | 70 | 135 | 120 | 200 | 140 | 120 | 220 | 140 | 120 |
| | | x | | 85 | 100 | 85 | 135 | 135 | 200 | 200 | 200 | 300 | 290 | 225 |
| DN80 DN100 | DN50 DN80 | | | 85 | 85 | 70 | 130 | 115 | 200 | 130 | 115 | 200 | 130 | 115 |
| | | x | | 85 | 100 | 80 | 135 | 135 | 200 | 200 | 200 | 300 | 270 | 215 |
| ESK4-FF / ESK4-PA | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | | | 70 | 60 | not adm. | 135 | 125 | 200 | 150 | 125 | 235 | 150 | 125 |
| | | x | | 85 | 60 | | 135 | 135 | 200 | 200 | 200 | 300 | 300 | 240 |
| DN80 DN100 | DN50 DN80 | | 65 | 60 | 135 | | 120 | 200 | 140 | 120 | 220 | 140 | 120 | |
| | | x | 85 | 60 | 135 | | 135 | 200 | 200 | 200 | 300 | 300 | 225 | |
| K1/K2 - 64 mW | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | | | 85 | 100 | 100 | 135 | 135 | 200 | 200 | 180 | 290 | 205 | 180 |
| | | x | | 85 | 100 | 100 | 135 | 135 | 200 | 200 | 200 | 300 | 300 | 300 |
| DN80 DN100 | DN50 DN80 | | | 85 | 100 | 100 | 135 | 135 | 200 | 185 | 170 | 260 | 185 | 170 |
| | | x | | 85 | 100 | 100 | 135 | 135 | 200 | 200 | 200 | 300 | 300 | 300 |
| K1/K2 (I7S23,5-N / SC3,5-N0-Y) - 169 mW | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | | | not adm. | | | 105 | 80 | 200 | 105 | 80 | 210 | 105 | 80 |
| | | x | | | | | 135 | 115 | 200 | 200 | 115 | 300 | 200 | 115 |
| DN80 DN100 | DN50 DN80 | | 105 | | | | 80 | 195 | 105 | 80 | 195 | 105 | 80 | |
| | | x | 135 | | | | 110 | 200 | 190 | 110 | 300 | 190 | 110 | |
| K1/K2 (SJ3,5-SN or SJ3,5-S1N) - 169 mW | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | | | not adm. | | | 135 | 135 | 200 | 195 | 170 | 295 | 195 | 170 |
| | | x | | | | | 135 | 135 | 200 | 200 | 200 | 300 | 300 | 300 |
| DN80 DN100 | DN50 DN80 | | 135 | | | | 135 | 200 | 180 | 160 | 275 | 180 | 160 | |
| | | x | 135 | | | | 135 | 200 | 200 | 200 | 300 | 300 | 300 | |
| R1/R2 (Reed SPST) | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | x | | 85 | 100 | 100 | 135 | 135 | 200 | 200 | 150 | 300 | 235 | 150 |
| DN80 DN100 | DN50 DN80 | x | | 85 | 100 | 100 | 135 | 135 | 200 | 200 | 145 | 300 | 220 | 145 |

Table 2-7: Maximum permissible product temperature in °C

| | | | | Maximum permissible product temperature T _m [°F] | | | | | | | | | | |
|---|--------------|------------|-------------------------|---|-------|----------|-------|-------|-------|-------|-------|--------|-------|-------|
| Heating jacket | | | TK ▶ | T6 | T5 | | T4 | | T3 | | | T2, T1 | | |
| without | with | HT version | T _{amb} [°F] ▶ | ≤ 104 | ≤ 140 | ≤ 149 | ≤ 140 | ≤ 149 | ≤ 104 | ≤ 140 | ≤ 149 | ≤ 104 | ≤ 140 | ≤ 149 |
| ESK4 | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | x | | 185 | 212 | 194 | 275 | 275 | 392 | 320 | 284 | 455 | 320 | 284 |
| | | | | 185 | 212 | 212 | 275 | 275 | 392 | 392 | 392 | 572 | 572 | 518 |
| DN80 DN100 | DN50 DN80 | x | | 185 | 212 | 185 | 275 | 266 | 392 | 302 | 266 | 428 | 302 | 266 |
| | | | | 185 | 212 | 212 | 275 | 275 | 392 | 392 | 392 | 572 | 572 | 491 |
| ESK4-T | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | x | | 185 | 194 | 158 | 275 | 248 | 392 | 284 | 248 | 428 | 284 | 248 |
| | | | | 185 | 212 | 185 | 275 | 275 | 392 | 392 | 392 | 572 | 554 | 437 |
| DN80 DN100 | DN50 DN80 | x | | 185 | 185 | 158 | 266 | 239 | 392 | 266 | 239 | 392 | 266 | 239 |
| | | | | 185 | 212 | 176 | 275 | 275 | 392 | 392 | 392 | 572 | 518 | 419 |
| ESK4-FF / ESK4-PA | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | x | | 158 | 140 | not adm. | 275 | 257 | 392 | 302 | 257 | 455 | 302 | 257 |
| | | | | 185 | 140 | | 275 | 275 | 392 | 392 | 392 | 572 | 572 | 464 |
| DN80 DN100 | DN50 DN80 | x | | 149 | 140 | | 275 | 248 | 392 | 284 | 248 | 428 | 284 | 248 |
| | | | | 185 | 140 | | 275 | 275 | 392 | 392 | 392 | 572 | 572 | 437 |
| K1/K2 - 64 mW | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | x | | 185 | 212 | 212 | 275 | 275 | 392 | 392 | 356 | 554 | 401 | 356 |
| | | | | 185 | 212 | 212 | 275 | 275 | 392 | 392 | 392 | 572 | 572 | 572 |
| DN80 DN100 | DN50 DN80 | x | | 185 | 212 | 212 | 275 | 275 | 392 | 365 | 338 | 500 | 365 | 338 |
| | | | | 185 | 212 | 212 | 275 | 275 | 392 | 392 | 392 | 572 | 572 | 572 |
| K1/K2 (I7S23,5-N / SC3,5-N0-Y) - 169 mW | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | x | | not adm. | | | 221 | 176 | 392 | 221 | 176 | 410 | 221 | 176 |
| | | | | | | | 275 | 239 | 392 | 392 | 239 | 572 | 392 | 239 |
| DN80 DN100 | DN50 DN80 | x | | | | | 221 | 176 | 383 | 221 | 176 | 383 | 221 | 176 |
| | | | | | | | 275 | 230 | 392 | 374 | 230 | 572 | 374 | 230 |
| K1/K2 (SJ3,5-SN or SJ3,5-S1N) - 169 mW | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | x | | not adm. | | | 275 | 275 | 392 | 383 | 338 | 563 | 383 | 338 |
| | | | | | | | 275 | 275 | 392 | 392 | 392 | 572 | 572 | 572 |
| DN80 DN100 | DN50 DN80 | x | | | | | 275 | 275 | 392 | 356 | 320 | 527 | 356 | 320 |
| | | | | | | | 275 | 275 | 392 | 392 | 392 | 572 | 572 | 572 |
| R1/R2 (Reed SPST) | | | | | | | | | | | | | | |
| DN15 DN25 DN50 | DN15 DN25 | x | | 185 | 212 | 212 | 275 | 275 | 392 | 392 | 305 | 572 | 460 | 305 |
| DN80 DN100 | DN50 DN80 | x | | 185 | 212 | 212 | 275 | 275 | 392 | 392 | 295 | 572 | 435 | 295 |

Table 2-8: Maximum permissible product temperature in °F

| | | | | Maximum permissible product temperature T_m [°C] | | | | |
|--|-----------------|----------------|------------------|--|----------|----------|---------|------|
| Heating jacket | | | TK ▶ | T6 | T5 | | T4...T1 | |
| without | with | HT version | T_{amb} [°C] ▶ | ≤ 40 | ≤ 60 | ≤ 65 | ≤ 60 | ≤ 65 |
| DN15... DN100 | DN15... DN80 | with / without | | | | | | |
| ESK4 / ESK4-T | | | | 40 | 65 | 65 | 65 | 65 |
| ESK4-FF / ESK4-PA | | | | 40 | 60 | not adm. | 65 | 65 |
| K1/K2 - 64 mW / R1/R2 | | | | 40 | 65 | 65 | 65 | 65 |
| K1/K2 (I7S23,5-N / SC3,5-N0-Y) - 169 mW | | | | not adm. | not adm. | | 65 | 65 |
| K1/K2 (SJ3,5-SN bzw. SJ3,5-S1N) - 169 mW | | | | not adm. | not adm. | | 65 | 65 |

Table 2-9: Maximum permissible product temperatures for painted measuring units in °C

| | | | | Maximum permissible product temperature T_m [°F] | | | | |
|--|-----------------|----------------|------------------|--|----------|----------|---------|-------|
| Heating jacket | | | TK ▶ | T6 | T5 | | T4...T1 | |
| without | with | HT version | T_{amb} [°F] ▶ | ≤ 104 | ≤ 140 | ≤ 149 | ≤ 140 | ≤ 149 |
| DN15... DN100 | DN15... DN80 | with / without | | | | | | |
| ESK4 / ESK4-T | | | | 104 | 149 | 149 | 149 | 149 |
| ESK4-FF / ESK4-PA | | | | 104 | 140 | not adm. | 149 | 149 |
| K1/K2 - 64 mW / R1/R2 | | | | 104 | 149 | 149 | 149 | 149 |
| K1/K2 (I7S23,5-N / SC3,5-N0-Y) - 169 mW | | | | not adm. | not adm. | | 149 | 149 |
| K1/K2 (SJ3,5-SN bzw. SJ3,5-S1N) - 169 mW | | | | not adm. | not adm. | | 149 | 149 |

Table 2-10: Maximum permissible product temperatures for painted measuring units in °F

Reference point observation

The permissible product and ambient temperatures may be exceeded or undershot as long as the permissible temperature range of the reference point of the display is not exceeded. The following table contains the permissible maximum values at the reference point.

Note:

- Reference point is the connection of the equipotential bonding conductor of the M40 indicator.
- The temperatures at the reference point are to be determined in the most unfavourable operating situation.
- The required measuring uncertainty is max. 2 K.
- Measuring conditions and results are to be permanently recorded in a suitable format.
- The measuring unit should be insulated properly.
- At temperatures above 70°C / 158°F, a heat-resistant cable must be used.

| Design of indicator | Component | Limit switch P _i [mW] | Maximum permissible temperatures at reference point T _{Ref} [°C] according to temperature class | | | |
|---------------------|---------------------|----------------------------------|--|-----------|-----------|-----------|
| | | | TK ▶ | T6 | T5 | T4...T1 |
| M40./../K. | SC3,5-NO-Y | 64 | | -20...+65 | -20...+80 | -20...+90 |
| | | 169 | | -20...+37 | -20...+52 | -20...+72 |
| | SJ3,5-SN | 64 | | -40...+66 | -40...+81 | -40...+90 |
| | | 169 | | -40...+42 | -40...+57 | -40...+86 |
| | SJ3,5-S1N | 64 | | -20...+66 | -20...+81 | -20...+90 |
| | | 169 | | -20...+42 | -20...+57 | -20...+86 |
| | I7S23,5-N | 64 | | -40...+70 | -40...+85 | -40...+90 |
| | | 169 | | -40...+52 | -40...+67 | -40...+90 |
| M40./../R. | Reed SPST | 1000 | | -40...+65 | -40...+65 | -40...+65 |
| M40./../ESK4/K. | SC3,5-NO-Y | 64 | | -20...+55 | -20...+70 | -20...+80 |
| | | 169 | | -20...+33 | -20...+48 | -20...+68 |
| | SJ3,5-SN | 64 | | -40...+55 | -40...+70 | -40...+80 |
| | | 169 | | -40...+38 | -40...+53 | -40...+80 |
| | SJ3,5-S1N | 64 | | -20...+55 | -20...+70 | -20...+80 |
| | | 169 | | -20...+38 | -20...+53 | -20...+80 |
| | I7S23,5-N | 64 | | -40...+55 | -40...+70 | -40...+80 |
| | | 169 | | -40...+48 | -40...+63 | -40...+80 |
| M40./../ESK4/R. | Reed SPST | 1000 | | -40...+55 | -40...+65 | -40...+65 |
| M40./../ESK4 | ESK4 | --- | | -40...+55 | -40...+70 | -40...+80 |
| M40./../ESK4-T | ESK4 and I/O module | --- | | -40...+52 | -40...+67 | -40...+77 |
| M40./../ESK4-FF | ESK4 and ESK4-FF | --- | | -40...+36 | -40...+51 | -40...+76 |
| M40./../ESK4-PA | ESK4 and ESK4-PA | --- | | | | |

Table 2-11: Maximum permissible temperatures at reference point of indicator in °C

| Design of indicator | Component | Limit switch P _i [mW] | Maximum permissible temperatures at reference point T _{Ref} [°F] according to temperature class | | | |
|---------------------|---------------------|----------------------------------|--|------------|------------|------------|
| | | | TK ▶ | T6 | T5 | T4...T1 |
| M40./../K. | SC3,5-NO-Y | 64 | | -4...+149 | -4...+176 | -4...+194 |
| | | 169 | | -4...+99 | -4...+126 | -4...+162 |
| | SJ3,5-SN | 64 | | -40...+151 | -40...+178 | -40...+194 |
| | | 169 | | -40...+108 | -40...+135 | -40...+187 |
| | SJ3,5-S1N | 64 | | -4...+151 | -4...+178 | -4...+194 |
| | | 169 | | -4...+108 | -4...+135 | -4...+187 |
| | I7S23,5-N | 64 | | -40...+158 | -40...+185 | -40...+194 |
| | | 169 | | -40...+126 | -40...+153 | -40...+194 |
| M40./../R. | Reed SPST | 1000 | | -40...+149 | -40...+149 | -40...+149 |
| M40./../ESK4/K. | SC3,5-NO-Y | 64 | | -4...+131 | -4...+158 | -4...+176 |
| | | 169 | | -4...+91 | -4...+118 | -4...+154 |
| | SJ3,5-SN | 64 | | -40...+131 | -40...+158 | -40...+176 |
| | | 169 | | -40...+100 | -40...+127 | -40...+176 |
| | SJ3,5-S1N | 64 | | -4...+131 | -4...+158 | -4...+176 |
| | | 169 | | -4...+100 | -4...+127 | -4...+176 |
| | I7S23,5-N | 64 | | -40...+131 | -40...+158 | -40...+176 |
| | | 169 | | -40...+118 | -40...+145 | -40...+176 |
| M40./../ESK4/K. | Reed SPST | 1000 | | -40...+131 | -40...+149 | -40...+149 |
| M40./../ESK4 | ESK4 | --- | | -40...+131 | -40...+158 | -40...+176 |
| M40./../ESK4-T | ESK4 and I/O module | --- | | -40...+126 | -40...+153 | -40...+171 |
| M40./../ESK4-FF | ESK4 and ESK4-FF | --- | | -40...+97 | -40...+124 | -40...+169 |
| M40./../ESK4-PA | ESK4 and ESK4-PA | --- | | | | |

Table 2-12: Maximum permissible temperatures at reference point of indicator in °F

2.7 Surface temperature for equipment protection level Db

For use in areas with combustible dust it should be noted that the indicated maximum surface temperature of T70°C at an ambient temperature of 65°C / 149°F and a product temperature of 70°C / 158°F is valid without a dust layer.

For higher product temperatures the maximum surface temperature is defined by the product.

2.8 Electrical data

| Electrical equipment | Nominal voltage | Nominal current |
|---|-----------------|------------------------------------|
| Limit switch K1 / K2 | 8 VDC | $\leq 1 / \geq 3$ mA |
| Reed switches R1 / R2 | 3...30 VDC | 0.1...100 mA |
| Signal output ESK4 | 14...30 VDC | 4...20 mA with HART® communication |
| Switching output ESK4-T, OC output | 8...30 VDC | 1...100 mA |
| Switching output ESK4-T, NAMUR output | 8 VDC | $\leq 1 / \geq 3$ mA |
| Signal input ESK4-T, input | 8...30 VDC | ≤ 2 mA |
| ESK4-FF Foundation Fieldbus transmitter ① | 9...24 VDC | 16 mA |
| ESK4-PA Profibus transmitter ② | 9...24 VDC | 16 mA |

Table 2-13: Electrical data

① Further information and instructions for operation of the ESK4-FF transmitter are provided in separate supplementary instructions.

② Further information and instructions for operation of the ESK4-PA Profibus transmitter are provided in separate supplementary instructions.

Built-in equipment for the variable area flowmeter may only be connected to separate intrinsically safe circuits with the following maximum values:

| Built-in equipment | Maximum values | | | | |
|----------------------|----------------|------------|------------|------------|------------------|
| | U_i [V] | I_i [mA] | P_i [mW] | C_i [nF] | L_i [μ H] |
| ESK4 | 30 | 130 | 1000 | ~ 0 | 10 |
| ESK4-T (I/O module) | 30 | 130 | 1000 | 10 | ~ 0 |
| ESK4-PA / ESK4 FF ① | 24 | 380 | 5320 | ~ 0 | ~ 0 |
| I7S23,5-N / SC3,5-N0 | 16 | 25 | 64 | 150 | 150 |
| | 16 | 52 | 169 | 150 | 150 |
| SJ3,5-SN / SJ3,5-S1N | 16 | 25 | 64 | 30 | 100 |
| | 16 | 52 | 169 | 30 | 100 |
| Reed SPST | 30 | 100 | 1000 | ~ 0 | ~ 0 |

Table 2-14: Maximum intrinsic safety values for built-in equipment

① FISCO field device



WARNING!

Also, when operating the variable area flowmeter outside of the hazardous area, the connection must be made to an intrinsically safe circuit. When connecting to non-intrinsically safe circuits, there is a risk of damage to the safety-defining components.

3.1 Mounting

Mounting and setup must be carried out according to the applicable installation standards by qualified personnel trained in explosion protection. The information given in the manual and the supplementary instructions must always be observed.

Variable area flowmeters must be installed in such a way that

- There is no danger from mechanical impact effects.
- There are no external forces affecting the indicator part.
- The device is accessible for any visual inspections that are necessary, and can be viewed from all sides.
- The nameplate is clearly visible.
- It can be operated from a location with secure footing.

Take special note of the installation position for the H250/H/... with horizontal flow direction:

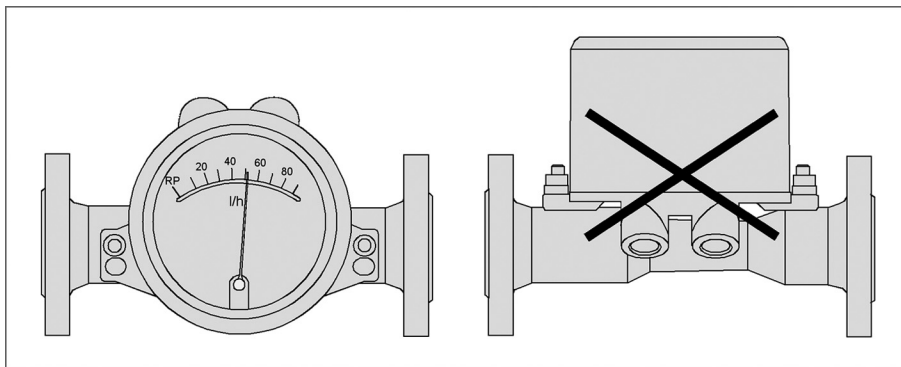


Figure 3-1: Installation position for the H250/H/... with horizontal flow direction

In order to comply with thermal parameters and measuring accuracy, flowmeters for horizontal installation are to be installed in the pipeline so that the display is located on the side of the measuring tube. The maximum product and ambient temperatures indicated as well as the measuring accuracy are based on lateral installation of the display.



CAUTION!

The manufacturer is not liable for any damage resulting from improper use or use other than the intended purpose. This applies in particular to hazards due to insufficient corrosion resistance and suitability of the materials in contact with product.



DANGER!

Components made of titanium in oxygen applications

*Variable area flowmeters with titanium components are **NOT** suitable for use in explosion-protected areas in conjunction with oxygen applications (products with an oxygen content which is significantly above the oxygen content in the earth's atmosphere)!*

3.2 Special conditions

Equipotential bonding

Connect the connection parts for the equipotential bonding of the H250 measuring unit and the M40 indicator to the equipotential bonding system of the hazardous area.



INFORMATION!

The ground terminal on the gate of the cable entry of the display guarantees an electrostatic connection of the device and complies with the requirements of an equipotential bonding connection.

Wetted parts made of titanium

When dealing with device versions with wetted parts made of titanium (TI option), use the protected installation to prevent sparking due to external impact and friction between titanium and other materials.

Flammable products

In case of operation with flammable products the measuring units must be included in the periodic tests of the pipelines and fittings.

IP protection

Use the cable entries and blind plugs supplied or similar types to guarantee an adequate IP protection class. Unused cable entries are to be closed.

Electrostatics

The variable area flowmeter type H250.../M40.../...../..Ex and the indicator type M40.../...../..Ex have a sight glass that can become electrostatically charged during cleaning. Observe additional information regarding electrostatics. For further information refer to *Electrostatic charge* on page 21.

Thermal data

Observe the maximum ambient and product temperatures. For further information refer to *Ambient temperature / temperature classes* on page 9.

4.1 General notes

The built-in equipment is connected electrically in the indication unit. The circuits are designed in type of protection "intrinsic safety" and galvanically isolated from ground (test voltage $\geq 500 V_{eff}$).

The connecting cables should be selected according to the applicable installation standards and the maximum operating temperature. Ensure that no residual current can form between separate intrinsically safe signal circuits.

- The connecting cables must be fixed and laid so they are sufficiently protected against damage.
- Not used cores must be securely connected to the earth potential of the hazardous area or carefully insulated against each other and against earth (test voltage $\geq 500 V_{eff}$).
- Lay cables so as to ensure that there is sufficient distance between surfaces of the measuring unit and the connecting cable.
- Supplied blind plugs / cable entries guarantee protection against foreign objects and water (ingress protection) IP66/68.
- The outer diameter of the connecting cable must be within the sealing range of the cable entry (8...13 mm / 0.31...0.51").
- Unused cable entries are to be closed in accordance with IEC 60079-1 and/or IEC 60079-31 (>IP66/68).

Ensure that the gaskets and incised gasket ring are tight.

4.2 Power supply

The variable area flowmeter does not require a separate power supply. The required supply for the built-in electronics is provided via the 4...20 mA current output or the bus connection.

4.3 Inputs/Outputs

The terminal assignment of the built-in electrical equipment is described in the standard documentation. The signal circuits of the variable area flowmeters may only be connected to certified intrinsically safe slave units or circuits. For more information refer to chapter "Electrical data".

4.4 Grounding and equipotential bonding

The signal converter shall be connected to the equipotential bonding system of the hazardous area via the internal or external grounding connection on the signal converter housing.

The measuring unit and the signal converter are electrically connected via an equipotential bonding connection.

Any existing cable shields should be connected to ground according to applicable installation regulations. A terminal in the terminal compartment permits a short way grounding of the cable shields.

Alternatively, the equipotential bonding of the signal converter can also take place by way of the measuring tube incorporated into the equipotential bonding of the hazardous area.

The measuring tube can be incorporated into the equipotential bonding system of the hazardous area using the U-clamp mounted on the flange if present, or suitable conductive connections (gaskets, etc.).

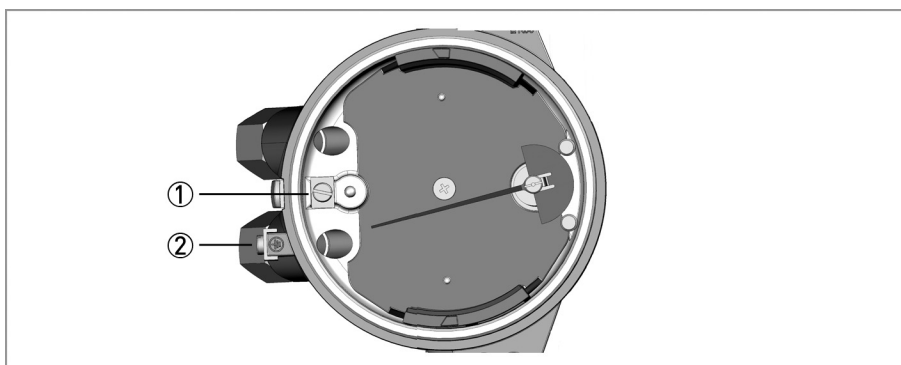


Figure 4-1: Grounding connections

- ① Grounding connection on the indicator
- ② Outer grounding connection

5.1 Start-up

Start-up is only permitted when the variable area flowmeter:

- is correctly installed in the system and connected.
- has been checked for the proper state with regard to its installation and connection requirements.

The user of the system must have it checked before start-up in compliance with the national regulations for checks before start-up.

5.2 Operation

Variable area flowmeters must be operated in such a way that they remain within the maximum and minimum permissible temperatures and pressures and the electrical limit values.

Variable area flowmeters may only be operated if the equipment parts necessary for safety are effective in the long run, and are not rendered inoperable during operation.

Adjusting the limit switch and operating the display during operation is permitted. To do so, remove the housing cover. Close the housing cover immediately after the adjustment of the limit switches or the operation of the display.

For more information refer to chapter "Dismantling".



WARNING!

Ignition risks caused by pressure surges, impact or friction must particularly be avoided when titanium measuring units are used.

5.3 Electrostatic charge

In order to avoid ignition hazards due to electrostatic charge, variable area flowmeters may not be used in areas with:

- processes that generate strong charges,
- mechanical friction and cutting processes,
- spraying of electrons (e.g. in the vicinity of electrostatic painting systems) or
- pneumatically conveyed dust is exposed.



WARNING!

Electrostatic charging of the housing surface by friction must be avoided. The devices must not be dry cleaned.

6.1 Maintenance

Maintenance work of a safety-relevant nature within the meaning of explosion protection may only be carried out by the manufacturer, his authorised representative or under the supervision of authorised inspectors.

For systems in hazardous areas, regular tests are required in order to maintain the proper condition.

The following checks are recommended:

- Check the housing, the cable entries and the feed lines for corrosion and/or damage.
- Checking the measuring unit and the piping connections for leakage.
- Check the measuring unit and the indicator for dust deposits.
- Including the flowmeter in the regular pressure test of the process line.

6.2 Dismantling

Exchanging the built-in equipment

Due to the modular design of the variable area flowmeters, from a safety perspective, the electrical equipment built into the indicator can be replaced with identical spare parts.

To do so, remove the housing cover. Close the housing cover immediately after the spare parts are exchanged. Ensure that the cover seal is tight.



CAUTION!

There may be a loss of measuring accuracy!

Exchanging the entire device

The dismantling and installation is within the responsibility of the operator.

Before disconnecting the electric connecting cable of the device, make sure that all cables leading to the indication unit are isolated from the ground of the hazardous area. This also applies to functional earthing conductors (FE) and equipotential bonding conductors (PA).



WARNING!

- *Pressurised pipes have to be depressurised before removing the measuring unit.*
- *In the case of environmentally critical or hazardous products, appropriate safety precautions must be taken with regard to residual liquids in the measuring unit.*
- *New gaskets have to be used when re-installing the device in the pipeline.*





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