Operation manual CAM 135

About this manual:

Read this manual carefully for safety instrutionsand operating guidance before installation!

1 Description

1.1 General information

The panel meter **CAM 135** is available for measurements of the most common DC-input signals used within industrial applications. Standard input signals ($\pm$ 0,2, $\pm$ 2, $\pm$ 20, $\pm$ 200 V, and 0 (4) ... 20 mA) 0- 10V are programmable with the reference display-ranges at the front side. Also the decimal point is programmable. For a special scaling of the display range a formula is given to select a resistor Rs for installation behind the front. Therefore the instrument is free scaleable within the display range of -1999...+1999 digits including free decimal point setting.

The thermocouple-versions provide automatically temperature compensation. The Pt 100 version is accessible for 2-, 3- and 4-wire sensors. Temperature ranges according to IEC/DIN are pre-set. The displayed measuring value can be read out via analogue output. Two floating relay contacts are available for activation external processes. Labels with physical dimension are interchangeable as you like.

With the CAM135 you can measure Frequency too.

1.2 Safety instructions

This instrument was built and tested according to VDE 0411/IEC 348 and was shipped in technically safe condition an to ensure safe operation. The user has to follow the hints and warnings given in these operating notes. The instrument may be operated only by trained persons. The instrument may be operated within specified environmental conditions , wich are listed in capture 3, without impairing its safety. Remove instrument and accessories from the packing. Check, if the instrument was damaged by improper handling during transportation and storage. If the instrument is so heavily damaged that safe operation seems impossible, the instrument must not be taken into operation. If the instrument is damaged and a safe operation seems impossible take the instrument out of operation and protect it against accidental operation. Before switch-on check that other equipment and/or facilities connected in the same signal loop is/are not affected. If necessary appropriate measures must be taken.

1.3 Maintenance

All repairs of the device may only be carried out by a specialist workshop. In case it is inevitable to carry out repairs on the opened device which is still supply voltage this may only be effected by trained specialist who knows about the dangers usually related to any such procedure. In case of misuse or wrong operation of the device we do not assume any liability for any damages that might occur.

1.4 Assembly instructions

Insert the instrument into the panel cut-out (regarding DIN 43 700) from the front. For overall dimensions see technical data.

Mount the housing at both sides using the two fixing clamps delivered with the instrument. Tighten the screws of the fixing clamps alternately until the housing is blocked. When mounting note that the permissible ambient temperature range under consideration of the heat radiation of adjacent equipment is not exceeded.

2 Operation

2.1 Starting

Standard input & display ranges at the **CAM 134** can be selected through jumper J2 at the front side. With the resistor Rs and the corresponding jumper-position any display range can be realised for voltage and current measurements. The decimal point is selected through jumper J1. The gain can be changed about $\pm$ 20% through the gain Potentiometer "V". The offset range is $\pm$ 500 digits related to the input signal of 0 VDC or 0 mA. It can be changed by Potentiometer "Np". With the solder pads A1 and A2 (see pict. 4) the offset can changed as follow:

A1 open	A2 closed:	$\pm$ 0Digit
A1 closed	A2 open:	$\pm$ 500Digit

In production we can change the offset bigger.

2.2 Adjustment of measuring range U / I

1. Remove the front frame. Choose the standard measuring range from table 1 or calculate Rs appropriate table 2. Put jumper J2 and connect Rs at pin 3 / 4 at the terminal block. (Pict. 1)
2. Apply the voltage or current for span start to terminal block pin 1 / 2.
3. Bring the display to the required value for span start using the zero Potentiometer "Np" (Pict. 4).
4. Apply the voltage or current for span end to the input terminal.
5. Bring the display to the required value for span end using the gain Potentiometer "V".
6. Repeat step 2 to 5 until the display corresponds to the required measuring range.
7. The decimal point will be adjusted with jumper J1.
8. Select the required label from the set of delivered labels and insert it into the cut-out behind the front foil. If the required physical dimension is not provided one of the blank labels can be fitted.

2.3 Adjustment of Pt100 / Thermocouples

1. Remove the front frame. By using a Pt 100-sensor in 2- or 3-wire technique connect bridges as shown in the connection diagram (Pict. 1).
2. Apply the value for span start with the Pt 100/TC-simulator to terminal block.
3. Bring the display to the required value for span start using the zero Potentiometer "Np" (Pict. 4)..
4. Apply the value for span end with the Pt 100/TC-simulator to terminal block.
5. Bring the display to the required value for span end using the gain Potentiometer "V".
6. Repeat step 2 to 5 until the display corresponds to the required measuring range.
7. Insert the label with the physical dimension into the cut-out behind the front foil.

Table 1:

Selection of measuring ranges:

Input **Voltage**	Display-span min	Display-span max.	Jumperposition J2
0 ... ± 200 V	± 1600	± 1999	3
0 ... ± 20 V	± 1600	± 1999	4
0 ... ± 2 V	± 1600	± 1999	-
0 ... ± 200 mV	± 1600	± 1999	5
Scale with Rs without jumper on J2			

Input **Current**	Display-span min.	Display-span max.	Jumperposition J2
0… 20 mA	1600	1999	2
4… 20 mA	1370	1999	2
Scale with Rs jumperposition 6 on J2			
With the resistors in the package you can scale this values.			
0… 20mA	500	760	6 / Rs = 31,6 Ω
0… 20mA	760	1140	6 / Rs = 47,5 Ω
0… 20mA	1140	1710	6 / Rs = 71,5 Ω
4… 20 mA	400	605	6 / Rs = 31,6 Ω
4… 20 mA	605	910	6 / Rs = 47,5 Ω
4… 20 mA	910	1370	6 / Rs = 71,5 Ω
Eingang **TC**	Min	Max	Jumper J2
Typ K	-160	1360	-
TYP J	-120	1200	4, 5
TYP L	-120	900	3, 5
TYP S	-50	1700	3

Tabelle 2:

Formula to calculate the scaling resistor Rs:

Voltage measument:

$$Rs[k\Omega] = \cfrac{1}{\cfrac{input\ volt\ age\ [V]}{required\ display\ [digit]} - 0,001}$$

Example 1:

Input voltage 0 ... 30 V,
required display 20,0 ... 120,0:
Display span: 1200 digit - 200 digit = 1000 digit

$$Rs[k\Omega] = \cfrac{1}{\cfrac{30}{1000} - 0,001} = 34,48\ k\Omega \approx 34,8\ k\Omega$$

Current measurement:

$$Rs[\Omega] = \frac{required\ display\ [digit]}{input\ current\ [mA]}$$

Example 2:

Input current 0 ... 20 mA,
required display -1,80 ... 14,20:
Display span: 1420 digit - (-180 digit) = 1600 digit

$$Rs[\Omega] = \frac{1600}{20} = 80\ \Omega \approx 80,6\ \Omega$$

2.4 Frequency measurement

For measuring the frequency, the input signal has to be connected to the terminals 3 and 4. The waveform is here almost irrelevant. The adjustment of the measurement range (50Hz… 10 kHz or 500Hz… 100 kHz) is done in factory. For the frequency measurement a minimal input amplitude of 0.75 V is required. The input amplitude must not exceed 30V for preventing damaging the device.
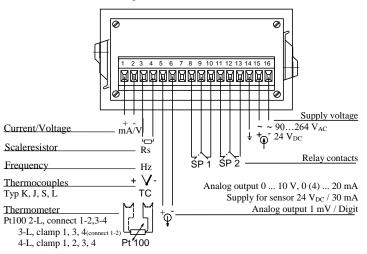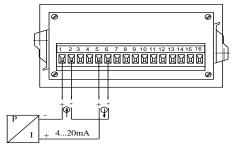
2.5 Limit contacts

By pressing the push button "Setpoint 1/2" the adjusted limit value is shown. With the Poti SP1/2 the limit value can be adjusted. If the measured value is lower then the adjusted limit value of SP1 relay 1 pick-up, if the measured value is higher then the adjusted limit value of SP2 relay 2 pick-up. If a relay is picked-up it is shown by the LED. Einstellung des Grenzwertes:

1. The lower and upper boundary of the setpoint are normally set on full range. They can be narrowed down to an required range.

2. The switching hysteresis is normally set on 3 digit. If you want, the range can be set like the Pt100 on – 100,0 … 199,9 °C 10 digit.

2.6 Front- and rear view CAM 135
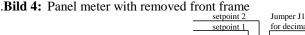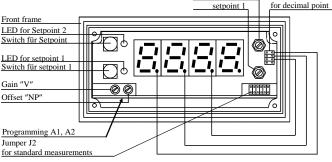
Bild 1: Connection diagramm

Current/Voltage mA/V
Scaleresistor Rs
Frequency Hz
Thermocouples + V -
Typ K, J, S, L TC
Thermometer
Pt100 2-L, connect 1-2,3-4
3-L, clamp 1, 3, 4(connect 1-2)
4-L, clamp 1, 2, 3, 4 Pt 100

Supply voltage
~ ~ 90…264 V_AC
24 V_DC
Relay contacts
SP 1 SP 2
Analog output 0 ... 10 V, 0 (4) ... 20 mA
Supply for sensor 24 V_DC / 30 mA
Analog output 1 mV / Digit

Bild 2: Connection of a 2-wire pressure transmitter

P
I + 4...20mA

.**Bild 4:** Panel meter with removed front frame

setpoint 2
setpoint 1
Jumper J1 for decimal point
Front frame
LED for Setpoint 2
Switch für Setpoint
LED for setpoint 1
Switch für setpoint 1
Gain "V"
Offset "NP"
Programming A1, A2
Jumper J2 for standard measurements

Jumperstellung J2
1 2 3 4 5 6

3 Technical data

Display: 7-Segment display, 13 mm LED red
Display range: ± 1999 digits
Decimal point: 0 ... 3 adjustable point
via jumper
Error indication: Display "1" at overrange
or sensor break
Display "- 1" at underrange
Segment-test: Jumper J1 at position „Test"

Meas. method: Dual Slope

Meas. rate: approx. 2,5 / sec.

Response time: < 2 sec. (at 100% step)

Input signals:

Voltage / Current DC:
Input range: 0 ... 10 V_{DC}, 0 (4) ... 20 mA,
scaling via jumper J2
0 ... ± 0,2 / ± 2 / ± 20 / ± 200 V_{DC}
(max. 350 V_{DC}) with jumper and Rs
Accuracy: ≤ ± 1 Digit ± 0,15 % of display value
Gain adjustment: max. ± 20 %
Offset adjustment: max. ± 1999 Digit
Temp. effect: ± 0,08 Digit / K (reference + 25 °C)

Thermocouples:

IEC	NiCr-Ni	Type K:	- 160 ...	1360 °C
IEC	FeCu-Ni	Type J:	- 120 ...	1200 °C
DIN	FeCu-Ni	Type L:	- 120 ...	900 °C
IEC	PtRh-Pt	Typ S	-50 ...	1700

Resolution: 1 K
Accuracy: ≤ ± 1,5 K ± 0,5 % of display value
Temp. effect: ≤ ± 0,05 °C / K (reference + 25 °C)
Input impedance: > 1 MΩ
Current: < 20 nA
Temperature compensation internal

Thermometer Pt100:
Connection for 2-, 3- or 4-wire sensors
2-wire connection max. 3 Ω resistance

Input range: - 100,0 ... + 199,9 °C
Resolution: 0,1 K
Accuracy: ≤ ± 0,2 K ± 0,1 % of display value
Temp. effect: ≤ ± 0,012 °C / K (reference + 25 °C)

Input range: -200 ... +700 °C
Resolution: 1 K
Accuracy: ≤ ± 1 K ± 0,2 % of display value
Temp. effect: ≤ ± 0,02 °C / K (reference + 25 °C)

Frequency measurement:

Input range: 50Hz ... 10kHz
Resolution: 10Hz
Accuracy: ≤ ± 10Hz ± 0,1 % of display value
Temp. effect: ≤ ± 0,1 Hz/ K (reference 25 °C)

Input range: 500Hz ... 100kHz
Resolution: 100Hz
Accuracy: ≤ ± 100Hz ± 0,1 % of display value
Temp. effect: ≤ ± 0,5Hz/ K (reference auf 25 °C)

Analogue output (option):
Output 0..10V, max. 5 mA load or
0 (4)...20 mA, burden max. 700 Ω
Influence of burden: ≤ ± 0,1 % (100% step)   Scaling range: -1999 … +1999
Max. Ripple: ≤ 0,2 %
Accuracy: ≤ ± 0,2 % of display-value
Temp. coefficient:≤ ± 100 ppm / K (reference +25 °C)

Limit contacts:
Two floating relay contacts, (Changer) min. and max contact, max. load 250 V_{AC} / 8 A, delay time: approx. 2 sec.
Hysteresis: 3 Digit standard (10 Digit at thermocouples)
Customised scaling of set point range on demand

Voltage output :
24 V_{DC} max. 30 mA, galvanically separated for sensors

Terminal block:
Terminal screws with wire protection for max. 1,5 mm^2

Ambient temperature:
0 ... 50 °C, no dew allowed

Supply voltage: galvanically separated
90.. V_{AC} ⎱ 48 ... 62 Hz,
264 V_{AC} ⎰ Power consumption: approx. 7 VA
24 V_{DC} 18 ... 36 V
Power consumption: approx. 4,5 VA
ripple: max. 100 mV$_{SS}$
for DC-supplement protection against pole reversal

Housing:
Glass-fibre reinforced Noryl, hardly inflammable
removable front frame
Dimension: approx. 96 x 48 x 135 [mm] (WxHxL)
incl. terminal block mounting depth appr. 126 mm
Recommended panel cut-out 92 x 45 [mm],
panel thickness max. 40 mm

Protection: Front panel IP 30,
Terminal block IP 20 (DIN 40050, IEC 144)

EMC References:
According to European Directive 89/336/EWG "Electromagnetic Compatibility" and 73/23/EWG "Low Voltage Directive". Meets with EN 61000-6-3, EN 61000-6-2 and EN 61010 for unrestricted industrial use

Weight (mass): appr. 490 g

Accessories: Panel meter with 2 attachment elements, operation manual, label set for physical dimensions: V, mV, A, mA, °C, %, bar, mbar, sec, 1/sec.