Instruction Manual for CAM 120

Measuring Instrument for DC/AC Measurements

Before the first use of this instrument:

Please read this instruction manual completely, and keep it for later reference.

Christ-Elektronik GmbH • Alpenstrasse 34 • 87700 Memmingen • GERMANY
Tel. +49–8331–8371–0 • Fax +49–8331–8371–99

1 Description

1.1 General Description

The built-in type measuring instrument CAM 120 allows measurements of almost any kind of analogue DC or AC signals. The desired mode of operation (DC or AC measurements) and the decimal point (scale magnitude) can be set using jumpers on the front side of the instrument. Analogue input signals [i.e. 2, 20, 200, 350 V (250 V_{AC}) and standardised signals 0...10 V, 0(4)...20 mA] can be readily scaled within the range of –1999...+1999 by means of a resistance at the terminals. Despite the small dimensions of the instrument, its LED display is easy to read even from a larger distance. Label strips with physical units may be exchanged as desired.

1.2 Safety Instructions

This instrument was designed in accordance with VDE 0411 / IEC 348, and passed standard quality-control tests. It left our production plant in perfect condition. The notes and warnings contained in this instruction manual must be followed to ensure safe operation of this instrument. This measuring instrument may be operated under the environmental conditions specified in chapter 3 without impairment of its operational safety. Any maintenance and repair work may only be performed by specially trained personnel who are familiar with any potential dangers and the warranty terms. Before its first use, this instrument has to be examined for any damage due to inappropriate transport or inappropriate storage. If, due to any possible damage, operation of this instrument might pose a hazard, it may not be used and has to be secured against unintentional use. In this case, all power supply lines have to be disconnected. Should the instrument be electrically connected with other devices or equipment, any possible effects need to be considered, and appropriate precautions taken, before the instrument is switched on or disconnected.

1.3 Repairs

Any repairs needed to this instrument are restricted to a qualified repair shop. If for any repair it is inevitable that the instrument remain open and connected to the power supply, such a repair may only be performed by a specialist who is familiar with any associated risks and hazards. We decline any liability for damages resulting from inappropriate operation or unintended use.

1.4 Installation Instructions

Place the measuring instrument into the designated cut-out (according to DIN 43 700, dimensions: 92mm x 22.2mm) on the front of your device frame. Please use the enclosed fastening parts to attach the instrument. Tighten the fastening bolts alternately until the instrument is securely fastened. When placing this instrument, consider radiant heat of neighbouring devices, and also take into account the permissible ambient temperature. Respect any applicable regulations (e.g. VDE 0100) when making electrical connections. The power supply voltage, as indicated on the electrical rating label, is connected to terminals 7 and 8. The protective-ground connection serves only as a protection against power surges and interferences from the power supply.

2 Operation

2.1 Setup

The built-in type measuring instrument CAM 120 allows the user to set up standard measuring ranges using scaling resistors at the terminals. The scaling resistor R_S adapts the instrument to a variety of voltage and current measurement tasks. The decimal point (magnitude) can be selected via a jumper on the instrument front panel. The amplification can be adjusted by ±20%. The scale zero-point for 0 V or 0 mA can be adjusted by approximately ±500 digits.

2.2 Setting Up the Measurement Range

1. Remove the front panel. On the bottom terminal row, place jumper for desired operation mode in accordance with table 3. Select the standard measuring range from table 1, or compute the required resistance using the formulas in table 2. Attach the appropriate scaling resistance R_S to terminals 4 and 5.
2. To set the measuring range minimum (offset), connect the voltage or current input to terminals 1 and 2, or 2 and 3.
3. Using the zero-point potentiometer "NP", adjust the display scale to the desired minimum (offset) value.
4. To set the measuring range maximum, connect the voltage or current input signal to the input terminals.
5. Using the amplification potentiometer "V", adjust display to the desired value.
6. Repeat numbers 2 to 5 until the display corresponds to the desired measuring range.
7. Using the jumper on the top terminal row, position the decimal point – see fig. 1.
8. Attach a label showing the physical unit between the front panel and the filter screen.

Table 1:
Choosing the scaling resistance:

Input	Min. Display Range	Max. Display Range	Resistance
0 ... ±200 V	±1600	±1999	R_S = 10 kΩ
0 ... ±20 V	±1600	±1999	R_S = 110 kΩ
0 ... ±10 V	±1600	±1999	R_S = 249 kΩ
0 ... ±2 V	±1600	±1999	– [1)]
0 ... 20 mA	500	760	R_S = 31.6 Ω
0 ... 20 mA	760	1140	R_S = 47.5 Ω
0 ... 20 mA	1140	1710	R_S = 71.5 Ω
0 ... 20 mA	1710	1999	R_S = 107 Ω
4 ... 20 mA	400	605	R_S = 31.6 Ω
4 ... 20 mA	605	910	R_S = 47.5 Ω
4 ... 20 mA	910	1370	R_S = 71.5 Ω
4 ... 20 mA	1370	1999	R_S = 107 Ω

1) AC measurement not without scaling resistance
$R_S \leq 1$ MΩ
Hint: Use only metal-film resistors with a tolerance of 1% and TK 50 for scaling resistance R_S.

Table 2:
General formulas to compute scaling resistances:

Voltage measurement:

$$R_S\ [k\Omega] = \frac{1}{\frac{\text{Input voltage}\ [V]}{\text{Display range}\ [digit]} - 0.001}$$

Example 1: Input voltage 0...30 V,
desired display range 20.0...120.0:

$$R_S\ [k\Omega] = \frac{1}{\frac{30}{1000} - 0.001} = 34.48\ k\Omega \approx 34.8\ k\Omega$$

Current measurement:

$$R_S\ [\Omega] = \frac{\text{Display range}\ [digit]}{\text{Input amperage}\ [mA]}$$

Example 2: Input current 0...20 mA,
desired display range –1.80...+14.20:

$$R_S\ [\Omega] = \frac{1600}{20} = 80\ \Omega \approx 80.6\ \Omega$$

Table 3:
Modes of operation:

DC Measurement	Jumper: J4
AC Measurement	Jumper: J1

2.3 Front and Back View

Fig. 1: Instrument without front panel

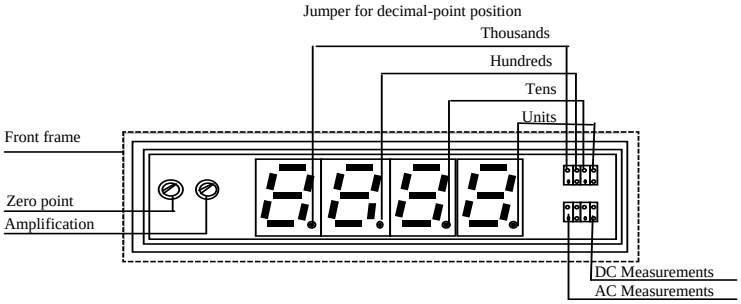
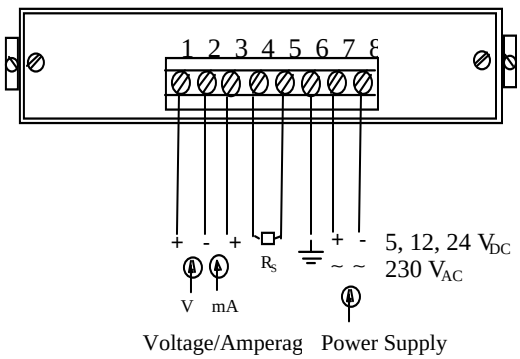


Fig. 2: Terminal pin assignment:



3 Technical Specifications

Display Screen	
Display	7-segment display, 13mm, red LED
Display range	±1999 digits
Decimal-point position	By means of a jumper behind the front panel
Error indication	"1" for values greater than the maximum and for broken sensors "–1" for values less than the minimum
Measurement Functions	
Measurement range setup	Via scaling resistance R_S at the terminals
Measurement principle	Dual slope
Measurement repeat rate	Approx. 2.5 measurements per second
Measurement delay	< 2 seconds for rapid changes
Measurement categories	Voltage, current
Measurement range	Standard signal (DC) 0...10 V_{DC}, 0(4)...20 mA_{DC} Voltage, current (DC) 0...±2/±20/±200/±350 V_{DC}; 0...±20/±200/±2000 mA_{DC} Voltage, current (AC) 0...2/20/200/250 V_{AC}; 0...20/200/2000 mA_{AC} Zero-point adjustment (offset): max. ±500 digits Inaccuracy: ≤ ±0.15 % of the displayed value ± 1 digit (for 0-10V and 0(4) – 20mA) Inaccuracy: ≤ ±1.5 % of the displayed value ± 1 digit (for all another values) Temperature influence: ±50 ppm/K (at 25 °C) Amplification adjustment: max. ±20 %
Electrical Power Supply	
Power supply	230 V_{AC} +10/–15 %; 48-62 Hz; 5 V_{DC}: 4.5-5.5 V_{DC}, 12 V_{DC}: 12-13.2 V_{DC}, 24 V_{DC}: 22.3-26.4 V_{DC}, each with electrical isolation; residual AC waves: max. 100 mV_{PP}
Fuse/circuit breaker	Reverse-polarity protection (only for DC versions) and temperature protection
Max. power consumption	AC: approx. 2 VA DC: approx. 1.4 W
EMC compatibility	According to EU directive 89/336/EEC, Electromagnetic Compatibility, and 73/23/EEC, Low-Voltage Directive. Satisfies EN 50081, EN 50082 and EN 61010 for unrestricted industrial applications.
Dimensions	
Dimensions (W x H x L)	Approx. 96 x 24 x 73 [mm]
Installation cut-out needed	92 x 22.2 [mm]
Installation depth	Approx. 66 mm
Material	Fibre-glass reinforced Noryl, flame-resistant, removable front panel
Mass (weight)	Approx. 120 g
Instrument panel thickness	Max. 5 mm
Installation fastening	By means of 2 fastening parts
Environment	
Operational temperature	0 ... 50 °C, no condensation
Protection category	In front of front panel: IP 50, terminals: IP 20 (DIN 40050, IEC144)
Protection class	II (protective insulation)
Electrical terminals	
Connector type	Attached screw-in terminals with wire protection for max. 1.5 mm^2