

**Operating instructions
Digital handheld
pressure gauge**



HM28

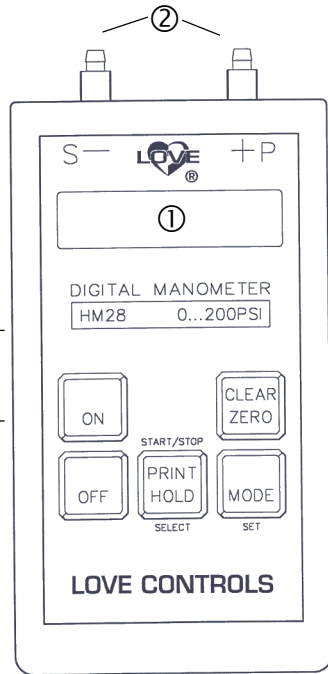
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Operating instructions

- ON = On
OFF = Off
MODE = Select operating mode
- Pressure measurement
- Min./Max.
- Leak rate
- Datalogging
CLEAR/ZERO = Zero setting
PRINT/HOLD = Print and freeze display
START/STOP = Data recording / printing
SET = Select config. modes
SELECT = Select config. data

- ① Matrix display
② Connection for pneumatic hoses
③ Connection for plug-in power supply unit
④ Connection for RS 232 interface



Important!

i Please note warning symbol in the operating instructions.

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Subject to dimension and design changes.

1 Description

The „LOVE CONTROLS“ handheld pressure gauge HM28 is a digital pressure measuring instrument with integrated pressure sensor for the measurement of differential, relative or absolute pressures and vacuum. Its versatile range of functions and high precision makes it suitable for a wide range of applications.

Configuration possibilities:

- Autom. switching off, selectable time
- Selectable resolution and damping
- Selectable units of time
- Selectable measurement units
- General reset to standard setting
- Selectable data transfer rate
- Configuration printout
- Selectable measuring intervals

2 Safety details

The pressure values stated on the rating plate and mentioned in these operating instructions must not be exceeded otherwise the pressure sensor can be destroyed.



Do not use the instrument in danger zones (explosives zones)!
Wear eye protection for pressures > 1bar!

3 Operating

3.1 Switching on and off

Switching on Press the ON key (the maximum permissible measuring range and the class appears on the display).

For precision measurements the instrument must be switched on for at least 1 minute (warm-up phase).

Switching off Press the OFF key, or automatic switching off 1, 10 or 60 min after the last keystroke.

In case of a temperature change the instrument requires at least 30 minutes to adjust to the new ambient temperature.

3.2 Pneumatic connection

For measuring ranges up to 7000 mbar, 4/6 mm or NPT 1/8" connectors can be connected depending on model. Higher ranges are equipped with NPT 1/8".

Ensure correct connection of the pneumatic hoses!

- +P** high pressure
- S-** low pressure (not available with the absolute and relative pressure version)

Measuring negative differential or relative pressures:

connect "S-" → negative pressure, or
change ports "S-" and "+P".

The HM28 will display a positive value.



When screwing on a coupling it is important to hold with a spanner in the opposite direction. Never hold at case only!

3.3 Operating modes

The modes in the matrix below can be selected in succession by pressing the MODE key.

After switching ON, the instrument is **always in the mode „normal“**.



| | | | Display example | Notes |
|---|--|--------------|---|--|
| Switching on | | | Max. Range: 200 mbar | Measuring range displayed in desired unit |
| | | | Full scale error 0.05 % | Accuracy class as a % of full scale reading |
| Normal (differential) and analogue/hold | print hold | zero display | 123.45 mbar ===== or HLD 123.4 mbar | Only with differential or relative pressure models Hold, store indicated value |
| Normal (absolute) and differential | print | zero diff | 1013.2 mbar DIF 1013.2 mbar | Only with absolute pressure mode Zero sets Diff to 0 |
| Zoom | print | zero display | 123.45 | Measurement in large figures |
| Min/Max | print | zero (reset) | MAX 150.0 mbar MIN 100.0 mbar | With absolute pressure, reset to actual value |
| Leak rate | print | zero display | 1234.5 mbar LEK 2.1 /min | Only with Diff./Rel. (unit/time unit) |
| Tendency (absolute) | print | | 1013.2 mbar TND - 15.7 /min | Only with absolute pressure (unit/time unit) |
| Record 1) | start/stop | clear memory | REC 432.1 mbar STOP 30 s MEM 1 | If measurement memory cleared |
| | | | REC 432.1 mbar RUN 30 s MEM 321 | Recording runs up to 964 values |
| | | | 432.1 mbar STOP 30 s MEM 901 | Recording stopped |
| Print Record | print quick keystroke: max. output speed Keystroke approx. 1s: single or fast output start/stop printing | | PRINT RECORD PUSH PRINT PRT 432.1 mbar 321 00:13:30 PRT Record stopped | Appears only if values are stored Printing / display with time Recording stopped |


1) at 70 bar the measurements are stored in [bar]




3.4 Configuration

Select mode:

Press  >2 seconds → on the display appears
CONFIGURATION

Store and exit:

Press  >2 seconds → on the display appears
SAVE CONFIGURATION

|  SET |  START/STOP SELECT |  | Display example | Notes |
|---|--|---|---------------------------------|--|
| set unit | mbar , kPa, bar, mmH ₂ O, mH ₂ O, mmHg, psi, inH ₂ O, inHg, hPa, Pa, MPa | 2) | UNIT mbar | |
| set resolution 1) | high low | | RESOLUTION high | Display resolution, influences measuring rate in RS 232 mode |
| set damping | off on | | DAMPING off | 90% recovery after 4 measurements (when ON) |
| set baudrate | 9600 , 4800, 2400, 1200 | | BAUDRATE 9600 | |
| set auto-off continuous | 1, 10 , 60 min continue | | AUTO OFF 10 min | Automatic switching off or continuous mode |
| set time unit hours | minutes hours | | TIME UNIT minutes | For leak rate, tendency |
| set Rec. interval 1) | 1, 5, 10, 20, 30, 60 s 2, 3, 5, 10, 30, 60 min manual, off | | REC INTERVAL 5 s (1.3h) | Off = record mode is deactivated (max. record interval) |
| set display rate | 2.5 Hz (400 ms) 5 Hz (200 ms) | | DISPLAY RATE 2.5 Hz (400 ms) | Normal mode indication/zoom (influences DAMPING) |
| general reset? | set on default values | zero | GENERAL RESET? PUSH ZERO | Reset all settings and clear measurement memory |
| | | | GENERAL RESET? RESET OK | After actuating ZERO |
| print configuration? | print now | | PRINT CONFIG? PUSH PRINT | Unit, ... |
| | | | PRINT CONFIG? PRINTING | After actuating PRINT |

1) If changed, the measurement memory is cleared 2) See in 4.1 "Technical data"

3.5 RS 232 mode

The HM28 can be remotely operated from a personal computer via an RS 232 interface. The automatic switching off (chapter 3.1) is inactive. Connection by means of a RS232-cable.

Plug pin assignment RS232, DB9 (female)

| Pin | Assignment | Pin | Assignment |
|-----|------------|-----|------------|
| 1 | DCD | 6 | DSR |
| 2 | TXD | 7 | RTS |
| 3 | RXD | 8 | CTS |
| 4 | DTR | 9 | SHIELD |
| 5 | GND | | |

Protocol

ASCII-commands

9600/4800/2400/1200 baud, 8 bit, no parity, 1 stop bit,
XON/XOFF - protocol (17 dec/19 dec)

Notes

- The HM28 is switched on when the supply voltage is applied
- The HM28 sends "XON" every 3 seconds
To determine the baud rate, read-in "XON" in each transfer rate until "XON" is correctly identified
- To go to remote control mode, interrogate "XON", immediately send the "remote" command and then read-in the acknowledgement "ok"
- Only lower case letters are accepted
- Observe > 0,1 s delay before the next command after "setbaud" command
- To acknowledge the answer of the HM28 without reading it back, just send a "XON"
- The symbol "*" followed by the checksum must be suffixed to each string. The string must be terminated with a CR
- A "TAB" is prefixed to each answer of the HM28, a "*" suffixed and the checksum sent.

The answer is terminated with a CR

- The checksum is formed from the least significant byte of the command string

Code-decoding of control command

«readconfig»

| Code | Configuration | Code | Configuration |
|----------------------|------------------------------------|-------------------------|---------------|
| Pressure unit | | Switch. off time | |
| 5 | MPa (7-70bar) | 0 | 60 min |
| 6 | Pa (25mbar-7bar) | 1 | continuous |
| 7 | kPa | 2 | 1 min |
| 8 | bar | 3 | 10 min |
| 9 | mH2O (with 70bar, otherwise mmH2O) | Time unit | |
| 10 | mmHg (not with 70bar) | 0 | /hours |
| 11 | psi | 1 | /minutes |
| 12 | inH2O | Storage interval | |
| 13 | inHg (not with 70bar) | 2 | 10 s |
| 14 | hPa | 3 | 20 s |
| 15 | mbar | 4 | 30 s |
| Resolution | | 5 | 60 s |
| 0 | low | 6 | 2 min |
| 1 | high | 7 | 3 min |
| Damping | | 8 | 5 min |
| 0 | on | 9 | 10 min |
| 1 | off | 10 | 30 min |
| Baudrate | | 11 | 60 min |
| 0 | 1200 Baud | 12 | manual |
| 1 | 2400 Baud | 13 | off |
| 2 | 4800 Baud | 14 | 1 s |
| 3 | 9600 Baud | 15 | 5 s |
| | | Display rate | |
| | | 0 | 5 Hz |
| | | 1 | 2.5 Hz |

Reply to control command «readconfig»

A whole number is returned as a reply

```

msb                                     lsb
####  ####  ####  ####
||||  ||||  ||||  ****-Pressure unit
||||  ||||  |||*-----Resolution
||||  ||||  ||*-----Damping
||||  ||||  **-----Baudrate
||||  |||*-----Switching off time
||||  |*-----Time unit
|***-*-----Storage interval
*-----Display rate

```

| Control commands/syntax | | Answer from HM28/syntax | | Description | |
|-------------------------|----------|---|-------------------------------|--------------|---|
| remote | * 182 CR | (tab)[ok] | * 13 CR | CR | Switch to remote control and block keypad |
| local | * 53 CR | (tab)[ok] | * 13 CR | CR | Switch to keypad |
| off | * 101 CR | (tab)[ok] | * 13 CR | CR | Switch off instrument |
| readpress | * 243 CR | (tab)"Value" | * Checksum | CR | Interrogate measurement |
| readpressfast | * 161 CR | (tab)"Value" | * Checksum CR (tab)"Value" | CR | Fast measurement interrogation "RESOLUTION high" output 10 M/s "RESOLUTION low" output 20 M/s |
| \$ | | (tab)[ok] | * 13 | CR | Exit "readpressfast" mode following send "XON" |
| readrange | * 211 CR | (tab)"Range" | * Checksum | CR | Interrogate measuring range |
| readbat | * 253 CR | (tab)"full"/"empty" | * 230/98 | CR | Interrogate battery capacity (lobat) (full=ok, empty=change) |
| readrecord | * 69 CR | (tab)"Recinterval" | (tab)"Value" | (tab)"Value" | Interrogate stored measured |
| | | (tab)[record_stopped] | * | CR | Recording is stopped |
| | | (tab)[out_of_range] | * | CR | Measurement out of range |
| | | (tab)[record_end] | * | CR | Recording stopped (waits at "XON" and sends back "ok") |
| readtemp | * 124 CR | (tab)"Value" | * °C | CR | Interrogate internal temperature, ±4 °C (±39 °F) |
| clearmem | * 112 CR | (tab)[ok] | * 13 | CR | Clear datalogging memory |
| readconfig | * 60 CR | (tab)Code (see decoding in table page 17) | * Checksum | CR | Readout actual configuration |
| setzero | * 54 CR | (tab)[ok] | * 13 | CR | Zero indication |
| setdefault | * 91 CR | (tab)[ok] | * 13 | CR | Reset all settings and clear memory, change to keypad |
| setunit_kpa | * 146 CR | (tab)[ok] | * 13 | CR | Corresponding units |
| setunit_mbar | * 248 | | | | see 4.1 Technical data |
| setunit_bar | * 139 | | | | |

| Control commands/syntax | | Answer from HM28/syntax | | Description |
|-------------------------|---------|-------------------------|----|--|
| setunit_mmh2o | * 57 | | | |
| setunit_mmhg | * 255 | | | |
| setunit_psi | * 162 | | | |
| setunit_inh2o | * 54 | | | |
| setunit_inhg | * 252 | | | |
| setunit_hpa | * 143 | | | |
| setunit_pa | * 39 | | | |
| setunit_mpa | * 148 | | | |
| setbaud_9600 | * 1 CR | (tab)[ok] | 13 | CR Select baud rate (answer with new baud rate, wait >0,1s before "XON") |
| setbaud_4800 | * 254 | | | |
| setbaud_2400 | * 248 | | | |
| setbaud_1200 | * 245 | | | |
| resolution_high | * 62 CR | (tab)[ok] | 13 | CR Select measurement resolution and indication, high:10 M/s, low: 20 M/s |
| resolution_low | * 240 | | | |
| settempmode_0 | * 33 CR | (tab)[ok] | 13 | CR Temp. measuring will be switched off at RS232 mode |
| settempmode_1 | * 34 | | | Temp. measuring will be done periodically (default value) |
| setrecint_off | * 86 CR | (tab)ok | 13 | CR Select storage interval (seconds) |
| setrecint_man | * 87 | (tab)ok | | |
| setrecint_1 | * 76 | (tab)ok | | |
| setrecint_5 | * 80 | (tab)ok | | |
| setrecint_10 | * 124 | (tab)ok | | |
| setrecint_20 | * 125 | (tab)ok | | |
| setrecint_30 | * 126 | (tab)ok | | |
| setrecint_60 | * 129 | (tab)ok | | |
| setrecint_2m | * 186 | (tab)ok | | |
| setrecint_3m | * 187 | (tab)ok | | |
| setrecint_5m | * 189 | (tab)ok | | |
| setrecint_10m | * 233 | (tab)ok | | |

| Control commands/syntax | | Answer from HM28/syntax | | Description | |
|-------------------------|----------|-------------------------|----|-------------|-----------------------|
| setrecint_30m | * 235 CR | (tab)ok | 13 | CR | |
| setrecint_60m | * 238 CR | (tab)ok | | | |
| setautooff_man | * 198 CR | (tab)ok | | | |
| setautooff_1 | * 187 | (tab)ok | | | |
| setautooff_10 | * 235 | (tab)ok | | | |
| setautooff_60 | * 240 | (tab)ok | | | |
| setdamp_off | * 115 CR | (tab)ok | 13 | CR | Damping off |
| setdamp_on | * 21 | (tab)ok | | | Damping on |
| setdisrate_2.5 | * 23 CR | (tab)ok | 13 | CR | Set display rate (Hz) |
| setdisrate_5 | * 183 | (tab)ok | | | |
| setunit_perh | * 5 CR | (tab)ok | 13 | CR | Tendency .../h |
| setunit_permin | * 225 | (tab)ok | | | Tendency .../min |
| | | (tab)[er] | 10 | CR | Error |

Note: The character _ indicates a space

3.6 Battery change

- Open battery receptacle
- Insert 9 V-alkali battery (IEC 6LR61) or accumulator

Ensure correct polarity!



Correct disposal of the used batteries according to environment regulations!

3.7 Recalibration

Recalibration to be carried out by specially skilled staff only.

Relevant instructions see in section 8. We recommend to recalibrate the instrument at least once a year.

4 Specifications

4.1 Technical data

| | |
|------------------------|---|
| Measuring media | instrument air or inert gases |
| Media-compatible types | all media compatible with stainless steel 18/8 (DIN 1.4305) |

| Units | Measuring ranges | | |
|--------------------|------------------|--------------|--------|
| | up to 7 bar | 10 to 30 bar | 70 bar |
| mbar | x | x | x |
| bar | x | x | x |
| Pa | x | - | - |
| kPa | x | x | x |
| hPa | x | x | - |
| MPa | - | x | x |
| mmH ₂ O | x | x | - |
| mH ₂ O | - | - | x |
| mmHg | x | x | - |
| psi | x | x | x |
| inH ₂ O | x | x | x |
| inHg | x | x | - |

Linearity, hysteresis and repeatability

(10 °C to 35 °C) ± 0,2 % F.S.
(50 °F to 95 °F) (standard) ± 1 digit
± 0,1 % F.S.
(option) ± 1 digit
± 0,05 % F.S.
(option) ± 1 digit
(according to measuring range)

Operating temperature -5 °C to 50 °C
(23 °F to 122 °F)

Storage temperature -20 °C to 60 °C
(-4 °F to 140 °F)

Humidity 30 to 95 % rH

Case protection class IP 54

Power supply 9 V-battery (IEC 6LR61) or accumulator
regulated plug-in mains supply unit
(7 to 14 VDC)

Current consumption <9 mA

Operating time (battery) appr. 70 h

Baud rate RS232 9600/4800/2400/
1200 baud

Measuring rate in RS232- mode

-Class 0,2 20 measurements/s
-Class 0,1 and 0,05 10 measurements/s

Measuring rate, normal mode 2 ½ or 5 measurements/s

Memory capacity max. 964 measurements

Memory interval manual, 1,5,10,20,30,60 s
2,3,5,10,30,60 min

Display LCD matrix, 2 lines of 16 characters

Pneum. ports hose 4/6 mm or NPT 1/8"

Case dimensions 152x83x34/29 mm

Weight incl. battery 270 g


4.2 Measuring ranges


| Metric Range | | English Range (rounded) | | Max. load capacity | | Max. static pressure | | | | | |
|--------------|-----|-------------------------|--------------------|--------------------|-----|----------------------|--------------------|------|-----|-----|------|
| 0 ... 2.5 | kPa | 0 ... 10 | inH ₂ O | 12.5 | kPa | 50 | inH ₂ O | 700 | kPa | 100 | psid |
| 0 ... 7 | kPa | 0 ... 28 | inH ₂ O | 35 | kPa | 140 | inH ₂ O | 700 | kPa | 100 | psid |
| 0 ... 20 | kPa | 0 ... 80 | inH ₂ O | 150 | kPa | 600 | inH ₂ O | 700 | kPa | 100 | psid |
| 0 ... 30 | kPa | 0 ... 120 | inH ₂ O | 150 | kPa | 600 | inH ₂ O | 700 | kPa | 100 | psid |
| 0 ... 50 | kPa | 0 ... 200 | inH ₂ O | 400 | kPa | 1600 | inH ₂ O | 700 | kPa | 100 | psid |
| 0 ... 100 | kPa | 0 ... 14.5 | psid/g | 400 | kPa | 58 | psid/g | 700 | kPa | 100 | psid |
| 0 ... 110 | kPa | 0 ... 15.9 | psia | 400 | kPa | 58 | psia | -- | | -- | |
| 0 ... 200 | kPa | 0 ... 29 | psia/d/g | 700 | kPa | 100 | psia/d/g | 700 | kPa | 100 | psid |
| 0 ... 700 | kPa | 0 ... 100 | psia/d/g | 1700 | kPa | 245 | psia/d/g | 1700 | kPa | 245 | psid |
| 0 ... 1000 | kPa | 0 ... 145 | psid/g | 2700 | kPa | 390 | psid/g | 2700 | kPa | 390 | psid |
| 0 ... 1700 | kPa | 0 ... 245 | psid/g | 2700 | kPa | 390 | psid/g | 2700 | kPa | 390 | psid |
| 0 ... 3000 | kPa | 0 ... 435 | psig | 7000 | kPa | 1000 | psig | -- | | -- | |
| 0 ... 7000 | kPa | 0 ... 1000 | psig | 14000 | kPa | 2000 | psig | -- | | -- | |

a = absolute pressure
d = differential pressure
g = relative pressure

Conversion factors

1 mbar = 0,1 kPa
1 mbar = 0,0010 bar
1 mbar = 10,20 mmH₂O
1 mbar = 0,7501 mmHg
1 mbar = 0,0145 psi
1 mbar = 0,4015 inH₂O
1 mbar = 0,02953 inHg
1 mbar = 1,0 hPa

 The maximum load capacity applies for relative overpressure and negative pressure. **The instrument is calibrated from 0 to 100% of the measuring range.** Exceeding or underrunning this range by up to about 10% is still displayed.

 **Differential pressure sensors (d) doesn't measure the same value on the P and S side mandatorily because of her geometry.**

4.3 Power supply unit connection

The HM28 can be operated by a regulated plug-in power supply unit.

Input 115V, 60 Hz
Output 9 V DC ± 20 %, 100 mA
(7 to 14 V DC)

5 Maintenance

The HM28 requires no maintenance. It can be cleaned with a damp cloth. Do not use cleaning agents containing solvents!

See the relevant chapters for **battery change** and **recalibration**.

6 Warning messages and faults

| Fault/indication | Possible cause | Remedy |
|--------------------------|---|---|
| ERROR OUT OF RANGE | 10% exceeding or under-running of measuring range | Apply permissible measuring pressure |
| CHANGE BATTERY | Battery voltage too low | Insert new battery |
| No change in measurement | Over pressure applied to pressure sensor | Dispatch instrument for repair |
| Does not switch on | No power supply | Fit new battery as required Battery possibly not correctly inserted Plug in power supply unit correctly |
| Instrument inaccurate | Inaccurate recalibration | Repeat recalibration |
| | Not zeroed | Vent and actuate zero |
| | Natural aging of the pressure sensor | Carry out recalibration |

7 Accessories

| | |
|----------|---|
| Standard | <ul style="list-style-type: none"> 1 9 V block battery 1 operating instructions |
| Option | <ul style="list-style-type: none"> Plug-in power supply unit 115V, 60Hz Leather case with carrying strap Service set Hand pump with variobellows 5bar Handpump 20 bar SCS test certificate Adapter RS232 9M-25F Adapter NPT1/8" Communication SW package comprising: <ul style="list-style-type: none"> - RS232-IF cable (9 pole fem.) - Communication-software for MS Windows - Measurement places management software for MS Windows |

8 Calibration instructions

Recalibration to be carried out by specially skilled staff only!

Actuate the following key combinations:

- First press MODE and keep it pressed
- Next and additionally, press CLEAR/ZERO and keep pressed until CALIBRATION is displayed

Exit from this mode is possible at any time via MODE or OFF.

The instrument must be in operation for at least 30 minutes (warm up stabilization time).

i New calibration values are only stored when **all five setpoints** have been running through correctly and

i **Calibration at 22 °C (71,6 °F) environmental temperature**

acceptable values acquired. In the event of a maloperation, the calibration process is interrupted and the previous calibration data are retained.

An incorrect internal instrument temperature can lead to accuracy fluctuations!

The pressure set points have to be set in [mbar]!

Check the instrument accuracy after recalibration!

| Calibration Point | Display | Execute | Notes |
|-------------------|---------------------------|---|--|
| | CALIBRATION | | |
| 0 % F.S. | CALIB 22 °C SET x mbar | - Set set point x - Press ZERO/CLEAR | 0 % F.S. not available with absolute pressure sensor |
| | OK | | |
| 25 % F.S. | SET x mbar | - Set set point x - Press ZERO/CLEAR | |
| | OK | | |
| 50 % F.S. | SET x mbar | - Set set point x - Press ZERO/CLEAR | |
| | OK | | |
| 75 % F.S. | SET x mbar | - Set set point x - Press ZERO/CLEAR | |
| | OK | | |
| 100 % F.S. | SET x mbar | - Set set point x - Press ZERO/CLEAR | |
| | CALIBRATION OK | | |

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