

**Operating instructions
Digital handheld
pressure gauge**



HM28

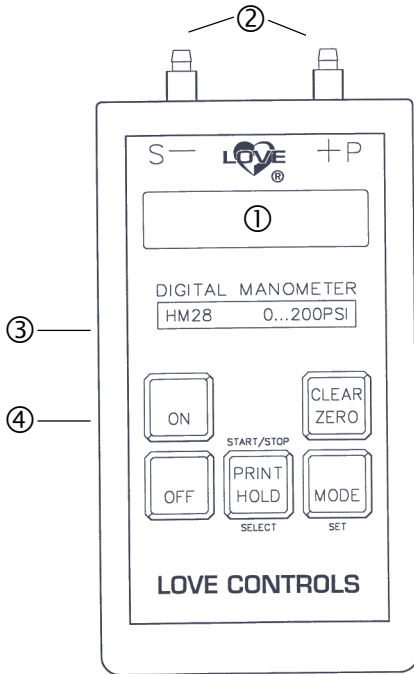
Contents

1	Description	4
2	Safety details	4
3	Operating	4
3.1	Switching on and off	4
3.2	Pneumatic connection	4
3.3	Operating modes	4
3.4	Configuration	6
3.5	RS 232 mode	7
3.6	Battery change	10
3.7	Recalibration	10
4	Specifications	10
4.1	Technical data	10
4.2	Measuring ranges	12
4.3	Mains supply unit connection	12
5	Maintenance	12
6	Warning messages and faults	13
7	Accessories	13
8	Calibration instructions	14

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.

Copyright (c) by LOVE CONTROLS.
The contents of this publication may not be copied without the express permission of LOVE CONTROLS.

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"	* Checksum	CR	Interrogate internal temperature, $\pm 4^{\circ}\text{C}$ ($\pm 39^{\circ}\text{F}$)
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
setbaud_4800	* 254			
setbaud_2400	* 248			
setbaud_1200	* 245			
resolution_high	* 62 CR	(tab)[ok]	13	CR
resolution_low	* 240			
settempmode_0	* 33 CR	(tab)[ok]	13	CR
settempmode_1	* 34			
setrecint_off	* 86 CR	(tab)ok	13	CR
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	13	CR	Select autom. switching off time (minutes)
setautooff_man	* 198 CR	(tab)ok	*	CR	
setautooff_1	* 187	(tab)ok	*	CR	
setautooff_10	* 235	(tab)ok	*	CR	
setautooff_60	* 240	(tab)ok	*	CR	
setdamp_off	* 115 CR	(tab)ok	*	CR	Damping off
setdamp_on	* 21	(tab)ok	*	CR	Damping on
setdisrate_2.5	* 23 CR	(tab)ok	*	CR	Set display rate (Hz)
setdisrate_5	* 183	(tab)ok	*	CR	
setunit_perh	* 5 CR	(tab)ok	*	CR	Tendency .../h
setunit_permin	* 225	(tab)ok	*	CR	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		

LOVE CONTROLS Division
Dwyer Instruments, Inc.
Highway 212 AT 12
Michigan City, IN 46360
USA
Phone ++1 219 879 8868
Fax ++1 219 872 9057