Operating instructions Digital handheld pressure gauge

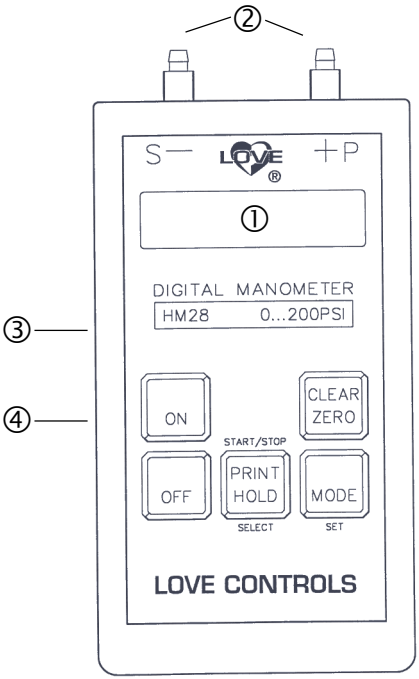
HM28

Contents

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!

Please note warning symbol in the operating instructions.

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“**.

MODE (SET)	START/STOP PRINT HOLD (SELECT)	CLEAR ZERO	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

			**Display example**	**Notes**
set unit	**mbar**, kPa, bar, 2) mmH_2O, mH_2O, mmHg, psi, inH_2O, inHg, hPa, Pa, MPa		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 RS 232, DB 9 (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

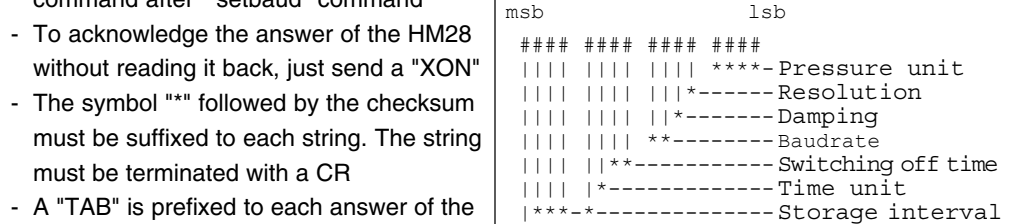
Code-decoding of control command «readconfig»

Code	Configuration
Pressure unit	
5	MPa(7-70bar)
6	Pa(25mbar-7bar)
7	kPa
8	bar
9	mH2O(with 70bar, otherwise mmH2O)
10	mmHg(not with 70bar)
11	psi
12	inH2O
13	inHg (not with 70bar)
14	hPa
15	mbar
Resolution	
0	low
1	high
Damping	
0	on
1	off
Baudrate	
0	1200 Baud
1	2400 Baud
2	4800 Baud
3	9600 Baud

Code	Configuration
Switch. off time	
0	60 min
1	continous
2	1 min
3	10 min
Time unit	
0	/hours
1	/minutes
Storage interval	
2	10 s
3	20 s
4	30 s
5	60 s
6	2 min
7	3 min
8	5 min
9	10 min
10	30 min
11	60 min
12	manual
13	off
14	1 s
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



Control commands/syntax				Answer from HM28/syntax									Description
remote	*	182	CR	(tab)[ok]						*	13	CR	Switch to remote control and block keypad
local	*	53	CR	(tab)[ok]						*	13	CR	Switch to keypad
off	*	101	CR	(tab)[ok]						*	13	CR	Switch off instrument
readpress	*	243	CR	(tab)"Value"	_	"Unit"	*	Checksum				CR	Interrogate measurement
readpressfast	*	161	CR	(tab)"Value"	*	Checksum	CR	(tab)"Value"	*	Checksum		CR	Fast measurement interrogation "RESOLUTION high" output10 M/s "RESOLUTION low" output 20 M/s
$				(tab)[ok]			*	13				CR	Exit "readpressfast" mode following send "XON"
readrange	*	211	CR	(tab)"Range"	_	"Unit"	*	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"	_	(tab)"Value"			Interrogate stored measured
				(tab)[record_stopped]						*	200	CR	Recording is stopped
				(tab)[out_of_range]						*	164	CR	Measurement out of range
				(tab)[record_end]						*	0	CR	Recording stopped (waits at "XON" and sends back "ok")
readtemp	*	124	CR	(tab)"Value"	_	°C	*	Checksum				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 setunit_mbar setunit_bar	* * *	146 248 139	CR	(tab)[ok]						*	13	CR	Corresponding units see 4.1 Technical data

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 (secondes)
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				Select storage interval (minutes)
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		(tab)ok				
setautooff_man	*	198	CR	(tab)ok	*	13	CR	Select autom. switching off time (minutes)
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 disposel 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_2O	x	x	-
mH_2O	-	-	x
mmHg	x	x	-
psi	x	x	x
inH_2O	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,	2 ½ or
normal mode	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	inH2O	12.5	kPa	50	inH2O	700	kPa	100	psid
0 ... 7	kPa	0 ... 28	inH2O	35	kPa	140	inH2O	700	kPa	100	psid
0 ... 20	kPa	0 ... 80	inH2O	150	kPa	600	inH2O	700	kPa	100	psid
0 ... 30	kPa	0 ... 120	inH2O	150	kPa	600	inH2O	700	kPa	100	psid
0 ... 50	kPa	0 ... 200	inH2O	400	kPa	1600	inH2O	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 mmH_2O
1 mbar = 0,7501 mmHg
1 mbar = 0,0145 psi
1 mbar = 0,4015 inH_2O
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 to100% 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 pressuresensor	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 1 9 V block battery
1 operating instructions

Option
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:
- 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)**.**

New calibration values are only stored when **all five setpoints** have been running through correctly and 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 at 22 °C (71,6 °F) environmental temperature

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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