

This data sheet is valid from SW-Release 1.11



Dimensions

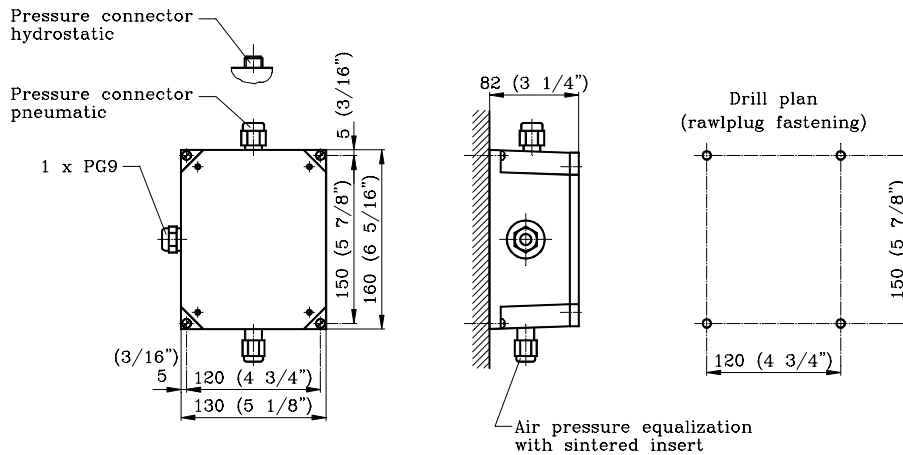
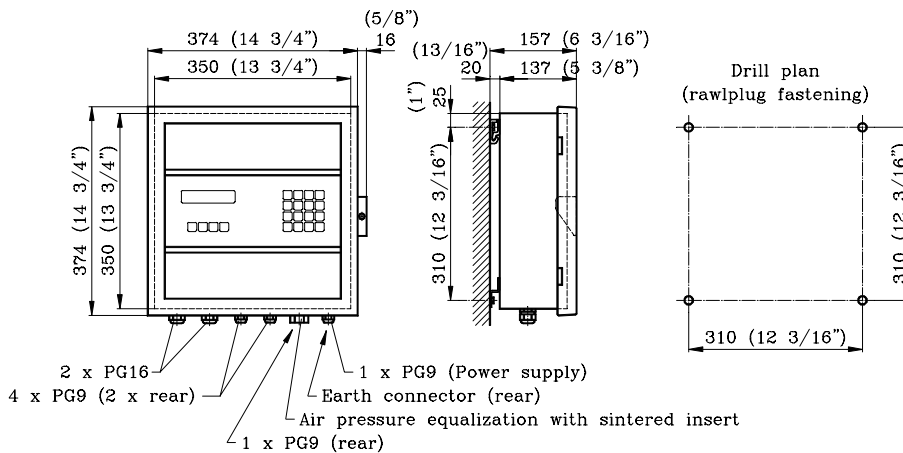


Figure 1: Pressure sensor



Dimensions in mm (inches)

Figure 2: Processing unit for wall mounting

Application

The MPW2Q high precision pressure gauge provides accurate measurement, display and transmission of water levels as well as pressures of liquid and gaseous media. Furthermore, the level gradient and the volume (by means of a curve entry method) can be calculated and displayed.

With the **hydrostatic level measurements MPW2QH** the pressure sensor is directly charged with the water column to be measured. The pressure sensor must be mounted below the lowest possible water level. The hydrostatic level measurement is restricted to use with water having the following characteristics:

- Drink and raw water, however no waste water
- no salinity
- pH-value between 6.5 and 7.5

With the **pneumatic level measurements MPW2QP** using the bubbling method, the pressure sensor can be mounted above as well as below the lowest possible water level.

The pressure generating air must be dry and free of oil as well as free of corrosive vapors.

Short description

The high precision pressure gauge uses quartz sensors where the pressure to be measured is applied to a bellow generating the pressure-induced load to a force sensitive quartz crystal. A change of full scale pressure results in a change of frequency in the order of 4 kHz whereas the frequency output at $p = 0$ is typically between 30 and 42 kHz. This frequency change is very precisely measured and linearised by the computing unit.

Temperature effects are compensated using a second quartz crystal sensor. The computing electronics measures the two frequencies f_p and f_v and calculates fully temperature compensated pressure or level. For correct level measurements, one or two sensors are necessary according to the selected measurement range. With smaller measurement ranges, the sensor P_{Level} is designed as a relative sensor with integrated correction of the atmospheric pressure.

With larger measurement ranges, a barometric sensor is necessary for correction of the atmospheric pressure. P_{Level} then measures the absolute pressure caused by the liquid column and $P_{Barometer}$ measures the atmospheric pressure. In the computing unit, $\Delta P = P_{Level} - P_{Barometer}$ is calculated what takes 750 milliseconds.

From the pressure value P_{Level} , or the differential pressure ΔP , the effective water level H is determined under consideration of the liquid-specific parameters density ρ , compressibility β , and the local gravity g . Furthermore, the gradient and the volume (by means of a curve entry method) can be calculated and displayed.

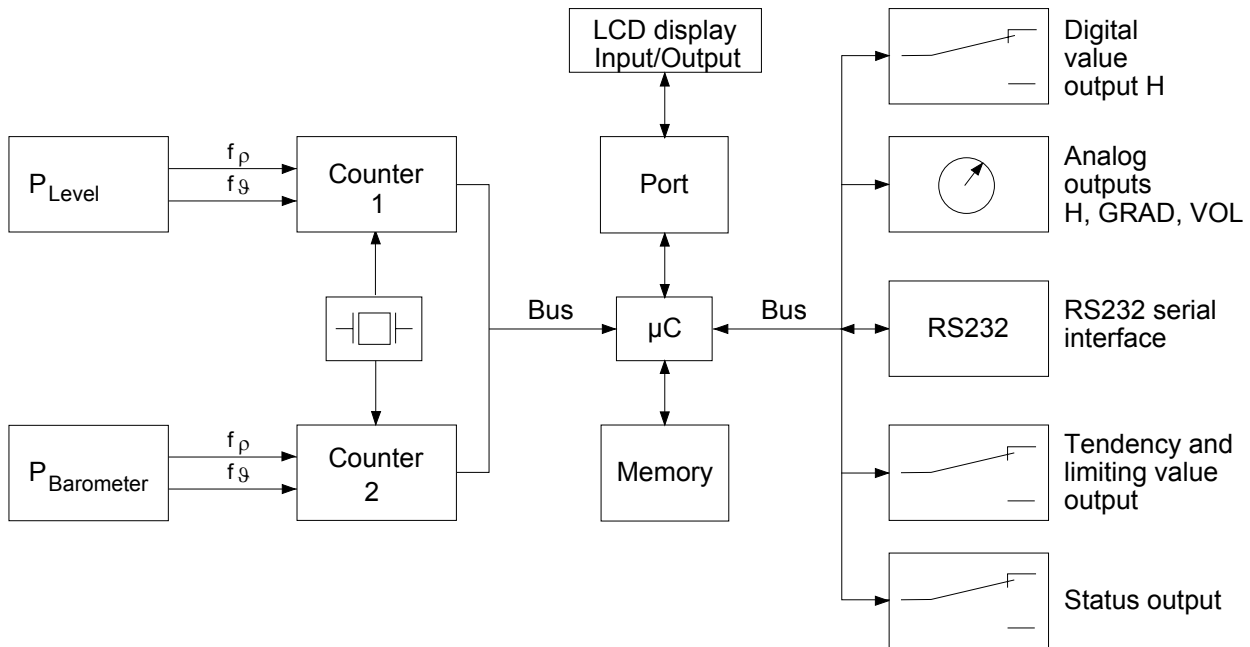


Figure 3: Block diagram, functional principle of level measurement

Design variations

Type	Power supply	Measurement range incl. offset-pressure	Part No. Wall mounting
MPW2QHN.020	AC 230/110 V	0 ... 20 mWS	Z 00 65 490.001
MPW2QHN.065	AC 230/110 V	0 ... 65 mWS	Z 00 65 490.002
MPW2QHN.100	AC 230/110 V	0 ... 100 mWS	Z 00 65 490.003
MPW2QHN.135	AC 230/110 V	0 ... 135 mWS	Z 00 65 490.004
MPW2QHN.200	AC 230/110 V	0 ... 200 mWS	Z 00 65 490.005
MPW2QHN.275	AC 230/110 V	0 ... 275 mWS	Z 00 65 490.006
MPW2QHK.xxx	DC 24 ... 48 V AC 24 ... 36 V	as above	Z 00 65 491.00x
MPW2QPN.020	AC 230/110 V	0 ... 20 mWS	Z 00 65 492.001
MPW2QPN.065	AC 230/110 V	0 ... 65 mWS	Z 00 65 492.002
MPW2QPN.100	AC 230/110 V	0 ... 100 mWS	Z 00 65 492.003
MPW2QPN.135	AC 230/110 V	0 ... 135 mWS	Z 00 65 492.004
MPW2QPK.xxx	DC 24 ... 48 V AC 24 ... 36 V	as above	Z 00 65 493.00x

Table 1: Part numbers

The instrument versions MPW2QHx.200 and MPW2QHx.275 are equipped with 2 pressure sensors.

Technical data - Pressure sensor

Construction, housing: Aluminium casting, blue/green NCS2060B60G

- Protection class: IP66 (NEMA4X)
- Cable inlet: 1 cable gland PG9
- Cable: max. 10m (33 ft), shielded 3 x 2 twisted-pair wires 0.5 mm² (AWG 20)
- Air pressure equalization: Serto cable coupling with sintered insert

	MPW2Qxx.020	MPW2Qxx.065	MPW2Qxx.100	MPW2Qxx.135	MPW2Qxx.200	MPW2Qxx.275
Measurement range terminal value (incl. offset-pressure)	0 ... 20 mWS (0 ... 65½ ftw)	0 ... 65 mWS (0 ... 213¼ ftw)	0 ... 100 mWS (0 ... 328 ftw)	0 ... 135 mWS (0 ... 443 ftw)	0 ... 200 mWS (0 ... 656¼ ftw)	0 ... 275 mWS (0 ... 902 ftw)
Overlead resistance without effecting precision	24 mWS (78¼ ftw)	80 mWS (262½ ftw)	120 mWS (393¼ ftw)	160 mWS (525 ftw)	230 mWS (754½ ftw)	315 mWS (1033½ ftw)
Resolution	< 1 mmWS < (5/128" ftw)	< 1 mmWS < (5/128" ftw)	< 1 mmWS < (5/128" ftw)	< 1 mmWS < (5/128" ftw)	< 1 mmWS < (5/128" ftw)	< 1 mmWS < (5/128" ftw)
¹⁾ Total error	≤ 3 mmWS ≤ 1/8" ftw	≤ 1 cmWS ≤ 25/64" ftw	≤ 1,5 cmWS ≤ 19/32" ftw	≤ 2 cmWS ≤ 25/32" ftw	≤ 3 cmWS ≤ 1 3/16" ftw	≤ 4,2 cmWS ≤ 1 21/32" ftw
Long term stability [% of EV/M]	≤ 0.016	≤ 0,016	≤ 0.016	≤ 0.016	≤ 0.016	≤ 0.016
Temperature dependency [ppm/°C of value]	≤ 8 ppm/°C ≤ 4.4 ppm/°F	≤ 8 ppm/°C ≤ 4.4 ppm/°F	≤ 8 ppm/°C ≤ 4.4 ppm/°F	≤ 8 ppm/°C ≤ 4.4 ppm/°F	≤ 10 ppm/°C ≤ 5.6 ppm/°F	≤ 10 ppm/°C ≤ 5.6 ppm/°F

Table 2: Technical data - Pressure sensor

Environmental temperature: -10°C ... +60°C with MPW2QP (+14°F ... +140°F)
+ 5°C ... +60°C with MPW2QH (+41°F ... +140°F)

¹⁾ The total error comprises the errors derived from non-linearity, hysteresis as well as non-repeatability.

Technical data - computing unit

Construction, Housing:	Standard design for wall mounting, design for switchboard integration available as an option
– Material:	Light metal, front with glass insert, lockable, blue/green NCS2060B60G
– Protection class:	Jet water proof according to DIN IP65, or NEMA4 and 4X
– Cable glands:	Cable couplings: 2 PG16, 6 PG9
2)Display:	Alphanumeric liquid crystal display with LED back-lighting 2 lines of 16 characters Character size 8 mm, 5 x 7 point matrix
– Operation:	Via front keyboard, keys with tactile feed-back, washable
– Voltage:	MPW2QxN.xxx: AC 110 V / AC 230 V \pm 20%, 48 ... 63Hz MPW2QxK.xxx: DC 24 V ... DC 48 V \pm 20% AC 24 V ... AC 36 V \pm 20%, 48 ... 63Hz
– Power consumption:	\leq 16 W or \leq 20 VA
– Overvoltage protection:	Inbuilt
– ³⁾ Connection:	Screw clamps for cross-sections \leq 1.5 mm ² (AWG 16)
2)Digital output:	Digitally coded output of level H for transmission or data processing, galvanically separated over relays
– Code:	BCD without sign, 0 ... 3'999'999 steps BCD with sign, -500'000 ... 1'999'999 steps Binär with sign, -500'000 ... 9'999'999 steps Gray with sign, -500'000 ... 9'999'999 steps
– Relays:	N.O. (make) contacts with a common connection
– Contact load:	Switching voltage max. DC/AC 60 V Switching current max. 0.5 A Constant current max. 0.5 A Switching power max. 30 W, 30 VA Contact material Rhodium Mech. life 10 ⁸ switching actions
– COM connections:	Constant current together max. 5 A (freely distributed)
– ³⁾ Connections:	Screw clamps for cross-sections \leq 1.5mm ² (AWG 16)

2) Update of display, relay and analog outputs every 750 ms.

3) An intermediate socket must be installed for conductor cross-sections $>1,5$ mm² ($>$ AWG 14).

2) **Limit value output:** 4 galvanically separated outputs, which can be individually assigned to the level, gradient or volume values. One of the 6 functions presented below can be selected for each output.

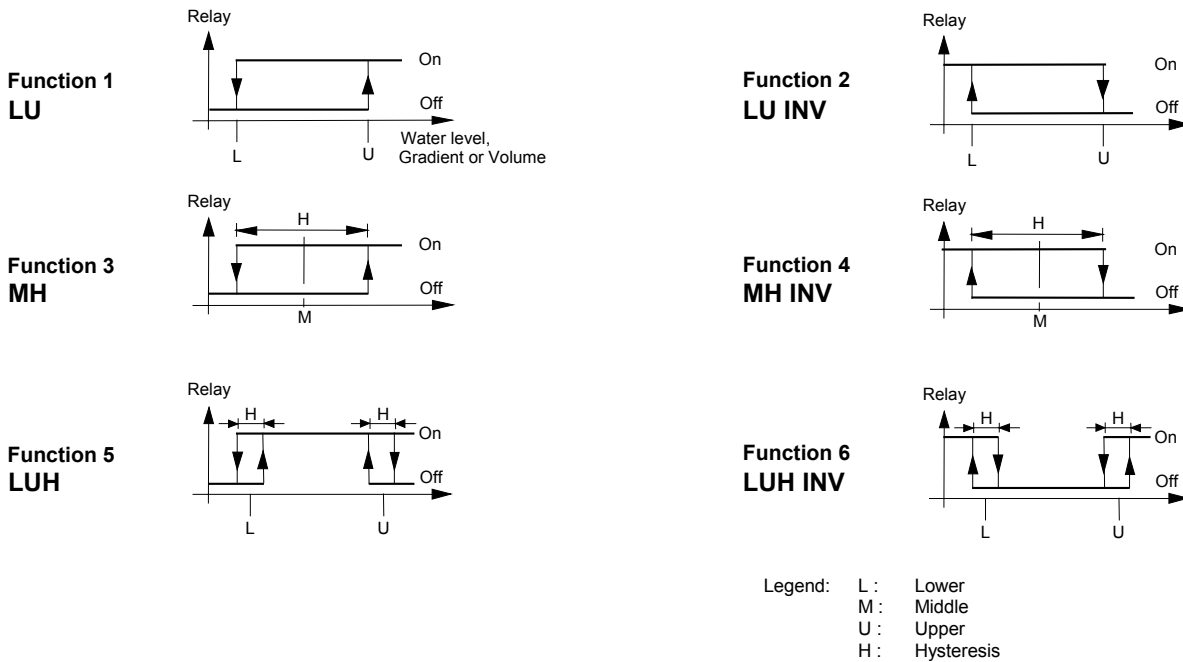


Figure 4: Limit value functions

- Relays: Changeover contacts
- Contact load: See digital output
- 3)Connections: Screw clamps for cross-sections ≤ 1.5 mm² (AWG 16)

2) **OK output:** Galvanically separated status output for the values.

The OK relay is in its off position (currentless condition) in the following cases:

- During start-up of the unit.
- Identification of an error during the cyclic test.
- A value is outside the allowed range (e.g. level H 10% above the measurement range end value).
- During the input of parameters or limit values as well as on activation of test functions.
- When the processor internal COP system identifies an error or defect (clock monitor, watch dog, reset, illegal opcode).

- Relays: Changeover contacts
- Contact load: See digital output
- 3)Connections: Screw clamps for cross-sections ≤ 1.5mm² (AWG 16)

2) **Trend output:** Galvanically separated output to the level trend display (rising, falling, stable)

- Relays: 3 N.O. (make) contacts with a common connection
- Contact load: See digital output
- 3)Connections: Screw clamps for cross-sections ≤ 1.5mm² (AWG 16)

2) Update of display, relay and analog outputs every 750 ms.

3) An intermediate socket must be installed for conductor cross-sections >1,5 mm² (>AWG 14).

2) Analog outputs:	One current output each for the level, gradient and volume values, freely selectable scale, not galvanically separated
– Signal:	Applied direct current 0 ... 20 mA or 4 ... 20 mA
– Resolution:	12 Bit
– Error: (total D/A conversion)	≤ 0.1 % FS
– Linearity:	≤ 0.04 % FS, typ. 0.01 % FS
– Temperature drift:	≤ 85 ppm/°C, typ. 37 ppm/°C (≤ 47 ppm/°F, typ. 21 ppm/°F)
– Maximum load:	≤ 500 Ω
– Load dependency:	Typ. 0.04 %
– Channel separation:	Typ. -76 dB
– Overvoltage protection:	Inbuilt fine protection ⁴⁾
– ³⁾ Connections:	Screw clamps for cross-sections ≤ 1.5mm ² (AWG 16)
RS232 Interface:	Serial interface for value output
– Interface configuration:	DTE, DEE (Data Terminal Equipment, Data Communication Equipment)
– Data format:	NRZ with 1 Start bit, 8 Data bits, 1 Parity bit (optional), 1 stop bit
– Baudrates:	Adjustable at 75 / 150 / 300 / 600 / 1200 / 2400 / 4800 / 9600 Baud
– Handshake:	Combined Hardware and Software handshake
– Telegraphic protection:	Even and odd parity and CRC check sum, both separately switchable on/off
– Mode of operation:	– Request for values by the master computer (e.g. RIDAT) – Automatic value output under consideration of a programmable hysteresis
– Topography:	Only point-to-point connections
– Cable lengths:	< 15 m (16 yd) RS232 direct < 4 km (2.5 mi) with H2D.ZCL current loop < 20 km (12 mi) with RVUTD23.xxx modem
– ³⁾ Connections:	Screw clamps for cross-sections ≤ 1.5mm ² (AWG 16)
Sensor connection:	External pressure sensor (P _{Level})
Environmental temperature:	-10°C ... +50°C (+14°F ... +122°F)
Measurement speed:	750 ms / measurement

2) Update of display, relay and analog outputs every 750 ms.

3) An intermediate socket must be installed for conductor cross-sections >1,5 mm² (>AWG 14).

4) Coarse protection ASBG.48 must be installed for use in the field or inside buildings with cable lengths ≥ 5 m or ≥ 100 m (≥ 16 ft or ≥ 328 ft).

Description of operation

All inputs take place interactively via the front-keyboard.

Measurement mode

The following 6 measurement modes are selectable:

- H mode Level measurement
- P1 mode Pressure (pressure sensor 1, P_{Level})
- P2-Mode Pressure (pressure sensor 2, P_{Barometer})
- P1-P2 mode Differential pressure P1-P2
- GRAD mode Gradient calculation
- VOL mode Volume calculation

The P2 and P1-P2 modes are only available with versions MPW2QHx.200 and MPW2QHx.275 with 2 pressure sensors. The interfaces are served in all 6 measurement modes.

H Mode

The level H is determined by the measured pressure value for a hydrostatic or pneumatic measurement arrangement. All interfaces can be served with the level values H. The parameters can be input in Parameter mode in accordance with the following table.

The text outputs are given in a selectable language from the respective combinations German/English, French/English, Spanish/English or Italian/English.

Parameter	Standard setting	Setting range
Measurement method	Hydrostatic	Hydrostatic, Pneumatic
Unit	m	m, masl, ft, ftasl
Display resolution	3	0, 1, 2, 3
Level H ₀	H ₀ = 0.000 m	-500.000 ... +9999.900 m
Offset	$\Delta H_1 = 0.000$ m (hydr.+ pneum.) $\Delta H_2 = 0.000$ m (pneum.)	-6.000 ... +99.900 m -300.000 ... +300.000 m
Relay output R ₀	R ₀ = 0.000 m	-500.000 ... +9999.900 m
Relay step	10 mm	1, 2, 5, 10, 20, 25, 50, 100, 200, 500, 1000 mm, 0.002; 0.005; 0.01; 0.02; 0.05; 0.1; 0.2; 0.25; 0.5; 1; 2 ft
Relay code	BCD with sign	BCD with/without sign, Gray code with sign, Binary code with sign
Analog output	0% = 0.000 m 100% = 0.000 m	-500.000 ... +9999.900 m -500.000 ... +9999.900 m
Current range	0 ... 20 mA	0 ... 20 mA, 4 ... 20 mA
Analog output	Off	Off, On
RS232 Baudrate	75 Baud	75, 150, 300, 600, 1200, 2400, 4800, 9600 Baud
RS232 Parity	None	None, Even, Odd
RS232 CR check	Off	Off, On
RS232 Hysteresis Δr	$\Delta r = 0.010$ m	0.000 ... 10.000m

Parameter	Standard setting	Setting range
Damping T_D	$T_D = 0$ s	0 ... 600 s
Mean ambient temperature T_A	$T_A = 5.00$ °C	-10.00 ... 40.00 °C
Level H_C	$H_C = 0.000$ masl	0.000 ... +9999.900 masl
Gravity g	$g = 9.8067$ m/s ²	9.7000 ... 9.9000 m/s ²
Density ρ	$\rho = 999.964$ kg/m ³	700.000 ... 1100.000 kg/m ³
Compressibility β	$\beta = 0.4900 \times 10^{-9}$ Pa ⁻¹	$0.4200 \times 10^{-9} \dots 0.5100 \times 10^{-9}$ Pa ⁻¹

Table 3: Mode parameters

P1-, P2- and P1-P2 modes

With these measurement modes, pressure value or the pressure difference of the sensor is displayed. Output of these values via the analog outputs or the digital output (relay) as well as the setting of limits for these values is not possible. However, all values can be transmitted via the RS232 interface.

The following parameters are available for each of modes P1, P2 and P1-P2:

Parameter	Standard setting	Setting range
Unit	bar	bar, mbar, kPa, hPa, psi, inHg
Display resolution	5	0, 1, 2, 3, 4, 5
Damping T_D	$T_D = 0$ s	0 ... 600 s

Table 4: P1, P2 and P1-P2 mode parameters

GRAD mode

With this mode, the instrument calculates the level gradient H according to the following rules:

1) Calculation formula:
$$GRAD = \frac{H_{t_2} - H_{t_1}}{t_2 - t_1}$$

whereby: H_{t_1} = level at point in time t_1 (beginning)
 H_{t_2} = level at point in time t_2 (end)

- The gradient is always newly defined when the level value H changes by a predetermined gradient threshold with the amount Δs . The desired amount of change can be entered by the user.
- Should the level change remain smaller than the amount quoted in 2), then the gradient will be set to zero after expiry of the time limit T_G . The time limit T_G is also freely programmable.

The GRAD values can be output over one of the analog outputs, the RS232 interface, but not over the digital output (relay). It is possible to assign a limit value output to the GRAD quantity to be measured.

The following parameter settings are available with the GRAD mode:

Parameter	Standard setting	Setting range
Unit	m/s	m/s, m/min, m/h, ft/s, ft/min, ft/h
Display resolution	3	0, 1, 2, 3
Gradient threshold	$\Delta s = 0.010 \text{ m}$	0.000 ... 10.000 m
Time limit T_G	$T_G = 5 \text{ s}$	0 ... 180000 s
Analog output	0% = 0.000 m/s 100% = 0.000 m/s	-1.000 ... +1.000 m/s -1.000 ... +1.000 m/s
Current range	0 ... 20 mA	0 ... 20 mA, 4 ... 20 mA
Analog output	Off	Off, On

Table 5: GRAD mode parameters

VOL mode

With this measurement mode, the corresponding volume VOL is calculated for each level value H. The user can programme the function $V = f(H)$ through the curve entry method using 2 ... 30 variables. Linear interpolation is then carried out between these points.

As with the GRAD values, the VOL values can also be output over one of the analog outputs, the RS232 interface, but not over the digital output (relay). It is possible to assign a limit value output to the VOL quantity to be measured.

The following parameters for the VOL mode can be entered via the keyboard:

Parameter	Standard setting	Setting range
Unit	m^3	l, m^3 , 10^3m^3 , 10^6m^3 , gal, ft^3 , 10^3ft^3 , 10^6ft^3
Display resolution	3	0, 1, 2, 3, 4, 5, 6
Number of points i_{\max}	$i_{\max} = 2$	2 ... 30
Function $V_i = f(H_i)$	$i = 1$ $H = 0.000 \text{ m}$ $\text{Vol} = 0.000 \text{ m}^3$	1 ... 30 within measurement range $0.000 \dots 999999.9 \times 10^6 \text{ m}^3$
Analog output	0% = 0.000 m^3 100% = 0.000 m^3	$0.000 \dots 999999.9 \times 10^6 \text{ m}^3$ $0.000 \dots 999999.9 \times 10^6 \text{ m}^3$
Current range	0 ... 20 mA	0 ... 20 mA, 4 ... 20 mA
Analog output	Off	Off, On

Table 6: VOL mode parameters

Limit mode

In the limit mode, the following settings can be made for each of the 4 available limit value outputs:

- Assignment of the limit value to one of the values to be measured H, GRAD or VOL
- Selection of one of the 6 possible limit value functions
- Input of the limit values L, M, U, H
- Release/block the limit value output

Test mode

The electronics are self-monitoring with a cyclic test. Additionally, the following tests can be separately called up:

- Data for the pressure sensors 1 and 2
- EPROM/RAM/EEPROM test
- Display test
- Test of the +/-15V supply
- Interface adjustment and test

Quality tests**CE-conformity to the EMC terms of reference of EU (89/336/EWG)**

The unit meets all requirements for the CE-identification in accordance with:

- EN 50081-1: 1992
- EN 50082-2: 1995

(see also conformity statement 21.281.0011000.001)

Additional EMC tests

- Surge ENV 50142, EN 61000-4-5 (IEC 1000-4-5): Test level 3 (2 kV)
(together with external overvoltage protection ASBG.48)
- Power supply interruption IEC TC77: Test level 3 (≥ 20 ms)
- Power supply dip IEC TC77: Test level 3 (≥ 20 ms)

Insulation tests in accordance with IEC 255-5

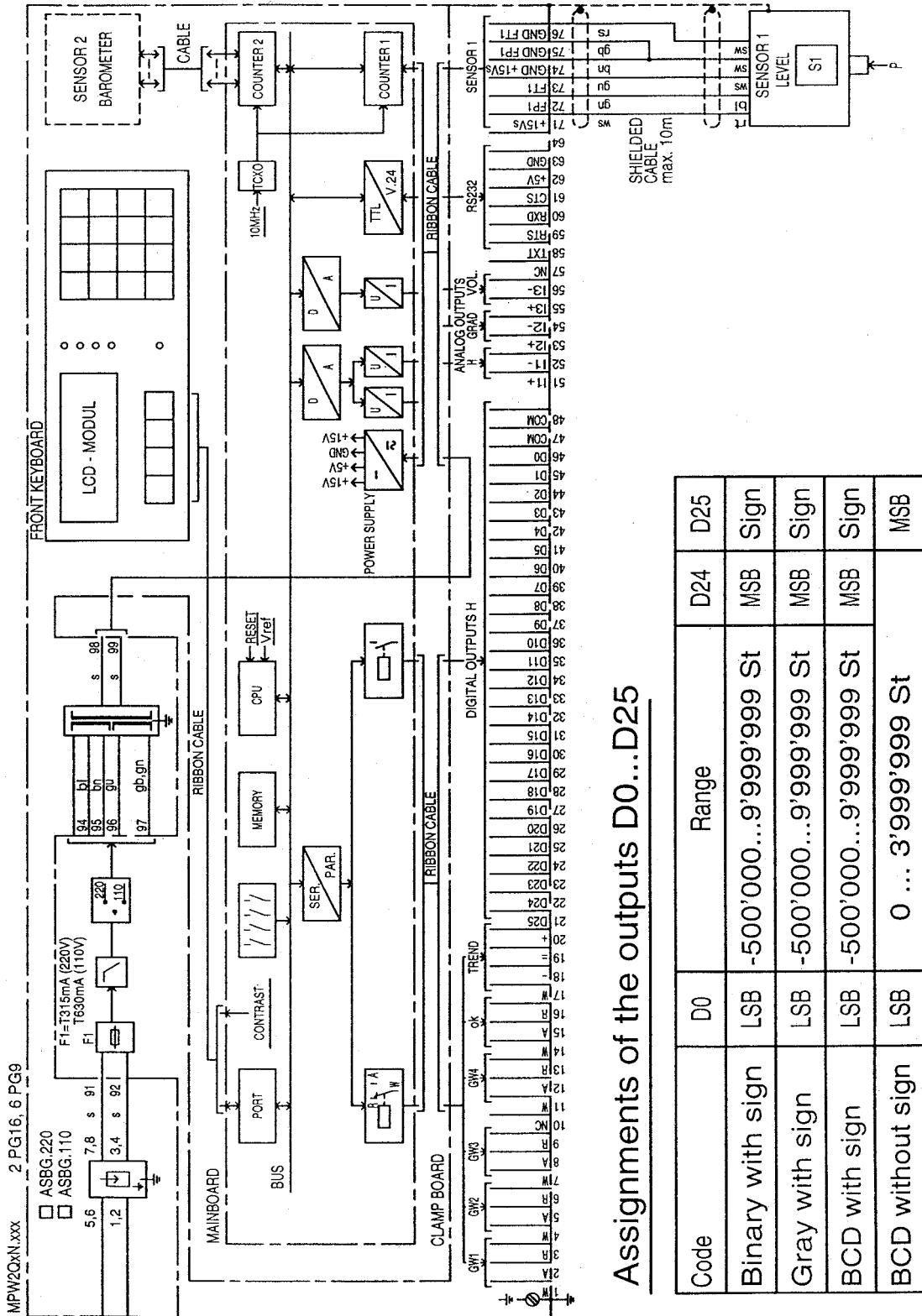
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|-------------------------------|----------|--|
| • Pulse withstandability test | MPW2QxK: | Test level 2 (1 kV) |
| | MPW2xQN | Test level 3 (2 kV) |
| • Dielectric strength | MPW2QxK: | Test level 2 (AC 500 V, 50Hz, 1 Min.) |
| | MPW2xQN: | Test level 3 (AC1000 V, 50Hz, 1 Min.) |
| • Insulation resistance: | | Test level 4 (≥ 100 M Ω) |

Accessories

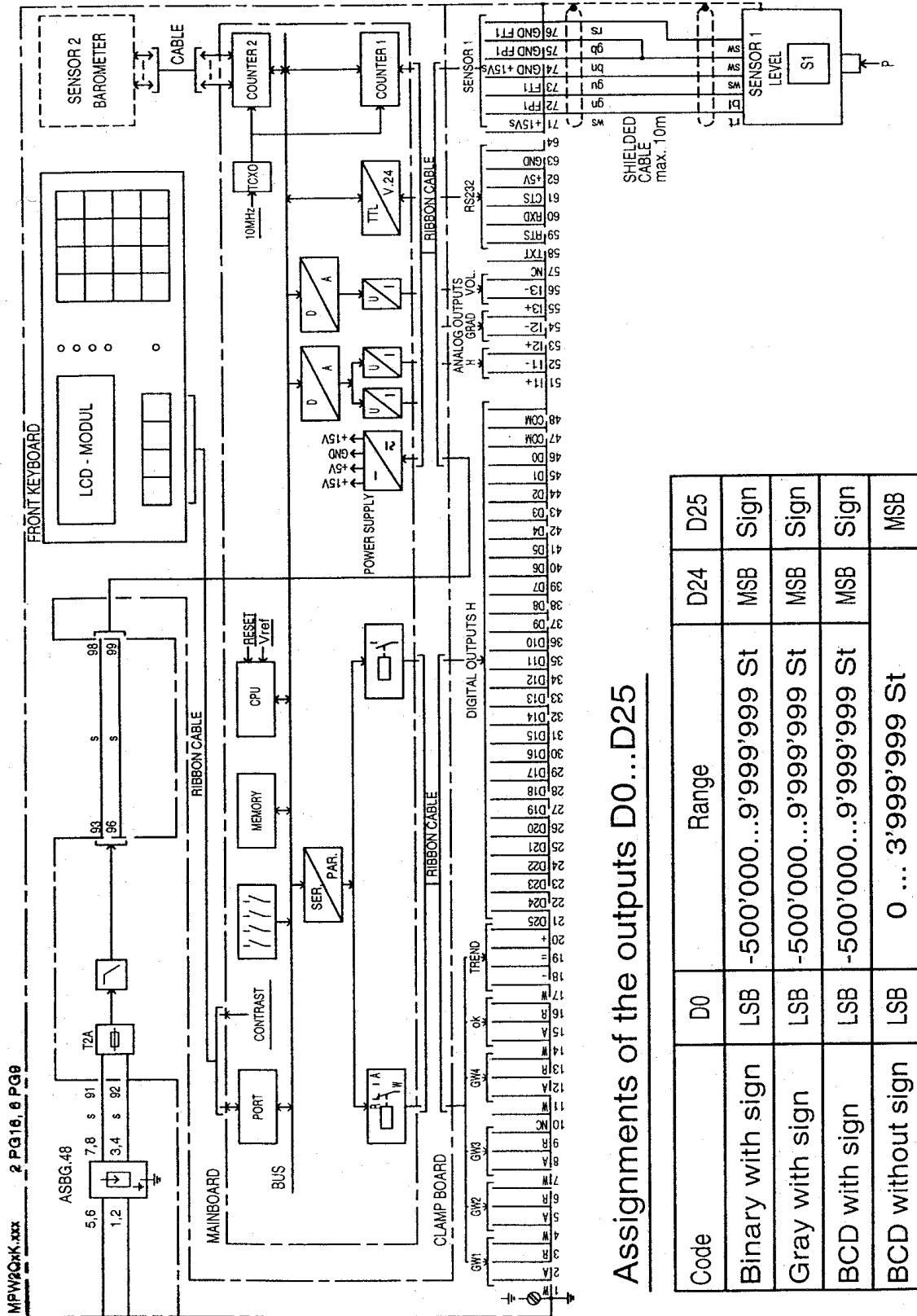
(see also standard accessories)

	Type	Part Nbr/Data sheet
– Overvoltage protection	ASBG.48	00 32 721.003
– For hydrostatic level measurement MPW2QHx.xxx:		
– Ball valve with screw connection, air relief screw, 5 cm Cu pipe 12/1, assembly material and silicon parting fluid	MPZKH	00 65 516.001
– Sensing cabinet including assembly material	ZWO.FH	L 00 36 131.001
– Sensing cabinet with heating	ZWO.FHH	Z 00 36 133.001
– Cu pipe 14/1		
– For pneumatic level measurement MPW2QPx.xxx:		
– Overpressure protection	ZWU.Ax	E 48 02 956
– Pneumatic control unit (incl. distribution piece and assembly material)	ZW2C.160	E 48 02 822
– Sensing cabinet including assembly material	ZWO.FP	L 00 36 130.001
– Sensing cabinet with heating	ZWO.FPH	Z 00 36 132.001
– Water collector for precipitation of condensed water	ZW2V.K	D 48 02 965
– Cu pipe 10/1		
– Polyethylene tube	ZWOP10.Px	
– Reinforced double tube	ZWOP10.PD	
– Polyamide 12 - tube 10/1.5		

PW2QxN.xxx connection diagram



MPW2QxK.xxx connection diagram



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