

**C9550 EXTERNAL
PRESSURE METER
OPERATING MANUAL**



CONTENTS

GENERAL INFORMATION	3
CALIBRATION, CERTIFICATION AND SERVICE	4
1 INTRODUCTION	6
1.1 Transducer Input	6
1.2 Transducer Operator Manual	6
1.3 Transducer Range Data Sheet	6
1.4 Ranges, scales and resolutions	6
2 KEY FUNCTIONS	7
2.1 ON/OFF Key	7
2.2 ZERO Key	7
2.3 SCALE Key	7
2.4 HOLD Key	8
2.5 FILTER Key	8
2.6 RECORD Key	8
2.7 AUTO Switch Off	8
3 PRESSURE SOURCE CONNECTION	9
4 OTHER FUNCTIONS	10
4.1 Battery Low	10
4.2 Over 9999 Reading Indication	10
4.3 Absolute or Gauge Measurement	10
4.4 Error Messages	10
4.5 Battery Replacement	11
5 UNITS OF MEASUREMENT	12
5.1 The C9550 Pressure Scaling System	12
5.2 Calibration Scale	13
Table 3. Scale Conversion Factors	13
5.3 Table of Full Scale Pressures and Resolutions	14

6	OPTIONAL EQUIPMENT	15
7.	WIRING OF INTERFACE CABLE	16
8.	INSTRUMENT SPECIFICATION	17
	Declaration of Conformity	18
FIGURE 1	View of the measurement system	19

GENERAL INFORMATION



WARNING

TRANSDUCERS SHOULD NOT BE DISCONNECTED FROM THE PRESSURE SOURCE WHILST CONTAINING GASES WHICH ARE DANGEROUS AND/OR UNDER PRESSURE.

DO NOT APPLY PRESSURES BEYOND THE OVER RANGE MAXIMUM FOR THE TRANSDUCER OR DAMAGE WILL OCCUR.

REFER TO SECTION 3 - CONNECTION TO PRESSURE SOURCES BEFORE OPERATING THE INSTRUMENT.

TO AVOID ELECTRIC SHOCK DO NOT ALLOW ANY TRANSDUCER OR CABLE TO COME INTO CONTACT WITH LIVE ELECTRICAL POWER CONDUCTORS WITH VOLTAGES IN EXCESS OF 30V AC RMS OR 60V DC.

CAUTION

Pressure Transducers

This precision instrument has been designed for use with the extensive range of Comark pressure transducers. The use of other transducers may impair the performance and accuracy of the instrument. Full details of Comark transducers may be obtained from Comark Customer Support department or your local distributor.

Repeated sharp flexing can break transducer connection cables. To prolong lead life, avoid sharp bends or kinks in the leads, especially near the connectors.



CERTIFICATE No. FM29700

This instrument is manufactured in accordance with the company's ISO 9001 Quality Approved System.

This instrument complies with the Electromagnetic Compatibility Directive EN61326-1:2006.



Declarations of Conformity available. Contact Comark Customer Support or your local Distributor.

In line with its policy of continuous development, Comark Limited reserves the right to alter the instrument specification without prior notice. Further information is available from Comark Limited or your distributor.



Certification

Comark can provide certificates of calibration for its whole product range, to suit ISO 9000 and other quality assurance procedures, food hygiene regulations, HACCPs and environmental regulations. Comark certificates are produced by independent quality controlled processes which compare product performance against agreed National Standards. For peace of mind and best practice Comark recommend annual certification/recalibration.

Two levels of certification are available for infra-red temperature and non temperature instruments, excluding humidity:- UKAS certificates via an external accredited laboratory and NPL traceable certificates from the Comark calibration laboratory.

Three levels of certification are available for contact temperature and humidity products and these are detailed here:

a) UKAS Temperature Certification

The Comark UKAS (United Kingdom Accreditation Service) accredited temperature calibration laboratory is one of the finest in the UK. Comark UKAS certificates can offer the lowest uncertainty of 0.01°C and provide independent proof of correct calibration using equipment and procedures audited by UKAS inspectors. The equipment used is fully traceable to the National Physical Laboratory.

b) UKAS Humidity Certification

In addition to the Comark temperature laboratory, the humidity laboratory continues the tradition of high accuracy certification and a wide range (25% to 90%RH) with uncertainties of 2.8% of reading. This range also includes Dew point measurements.

c) NPL Traceable Certification

Comark NPL certificates are traceable to the National Physical Laboratory and can offer uncertainty as low as 0.3°C.

Conformance

Certificates of conformance can be supplied for new, serviced and recalibrated instruments. These confirm that instruments are within their original manufactured specification.

Service/Repairs

Regular servicing and any required repairs, under warranty or after, are available from the Comark Service Department.

For more information on all Comark certification, calibration and service facilities please call Comark Customer Support or contact your local distributor.

1.1 Transducer Input

The C9550 external pressure meter accepts all Comark pressure transducers model 3392, 3393, 3397 or 3398. Connection is made by means of the 8-pin socket and the 1.5 metre interface cable. An inbuilt serial interface allows the C9550 to communicate with the transducer and provide correct display of the pressure value in any one of the pressure units selected. Suitable pressure transducers are:

Model	Pressure range, bar	Diaphragm	Type
3392/PG Series	0.1 to 4000	Internal	Gauge
3393/PA Series	0.25 to 16	Internal	Absolute
3397/PGF Series	0.1 to 600	Front Flush	Gauge
3398/PAF Series	0.25 to 16	Front Flush	Absolute

Table 1. Transducer Model References

1.2 Transducer Operator Manual

The separate Transducer Operator Manual provides details of the installation, troubleshooting and calibration of transducers.

1.3 Transducer Range Data Sheet

Pressure ranges extend from 0.1 to 4000 bar. The separate Transducer Range Data sheet, Ref: C089, lists all pressure ranges available in each of Gauge / Absolute, Internal Diaphragm / Front Flush Diaphragm, 0.5% / 0.25% accuracy types.

1.4 Ranges, scales and resolutions

A tabular listing of the scales and resolutions of Comark stocked ranges is provided in section 5.3. The complete listing for all 24 ranges is available separately as Engineering Note 18, and is available from the Customer Service Department.

2.1 ON/OFF Key

Press once to switch on the instrument. Repeat to switch off.

Holding down the key when switching on will display the maximum pressure range for the attached transducer in Bar. When the key is released the previously set pressure units will be employed.

Holding down the key when switching off will display all segments as a test.

2.2 ZERO Key

Press to zero the current readings on the display to nullify any offsets caused by large temperature variations, or to provide a tare function. The instrument discards any such offset when switched off, and will apply no offset when switched back on. The zero key can be used whenever offsets occur. Please note that pressing the zero key has no effect whilst the instrument is in hold or record modes.

Note that if the zero function is used to set to zero (tare) a standing pressure reading, the -02- overpressure warning will continue to occur at 110% of full scale transducer pressure, although the numerical value displayed will not then be 110% of full scale. This ensures that the display warning for overpressure will apply to the safety of the transducer.

2.3 SCALE Key

Press to display the pressure measurement in each of the different scales available. The selected scale unit is retained in memory even after switch off, so that the selected unit can be displayed when the instrument is switched on again.

See Section 5 for a fuller explanation of the C9550 pressure scaling system.

2.4 HOLD Key

Press to hold the displayed reading and press again to resume measurement. The scale key will operate while the instrument is in hold mode so that the held reading can be displayed in different scales.

2.5 FILTER Key

Press to filter out transient readings. In filter mode the instrument will average the readings taken over the last 4 seconds (16 readings) to provide a more stable reading on the display. Press the key again to resume normal measurement.

2.6 RECORD Key

Press once to put the instrument into record mode. This will be indicated by the word RECORD on the display. Maximum and minimum pressure readings can be stored and displayed while the instrument is in record mode. When the instrument is in record mode, press key once to display the current maximum reading and press again to display the current minimum reading. Pressing the key a third time will return the display to normal measurement.

Record mode can be cancelled and the max/min readings cleared by pressing and holding down the key until the word RECORD disappears from the display.

The scale key will operate while the instrument is in record mode so that the max/min readings can be displayed in different scales.

2.7 AUTO Switch Off

The instrument can be programmed to auto switch off by pressing and holding down the HOLD key while using the ON/OFF key to switch on the instrument. The word AUTO appears on the display to indicate auto switch off mode and the instrument will switch itself off approximately 3 minutes after the last use of the keypad. Auto switch off mode can be cancelled by pressing and holding down the HOLD key while switching on manually with the ON/OFF key.

3 PRESSURE SOURCE CONNECTION

Transducers for use with the C9550 instruments are fitted with G $\frac{1}{2}$ A male connectors. The following checks must be made before connecting them to a pressure source:-

- See warnings on page 2.
- Refer to the separate Transducer Operator Manual.
- Please ensure that you check your own safety standards before connecting to a pressure source.
- Check the security of all fittings.
- Do not undo pressure connections until the pressure is released first.
- Check the pressure rating on the transducer label.
- Check that the pressure source does not exceed the ratings for the transducer as set out in Table 2.
- Check that the gases to be measured will not damage or corrode the stainless steels in the transducer.

Transducer Pressure Ranges	Maximum Overpressure
0.1 to 16 bar	350% of Full Scale
25 to 600 bar	200% of Full Scale
1000 bar	150% of Full Scale
1600 to 4000 bar	120% of Full Scale

Table 2. Overpressure limits for ranges

4.1 Battery Low

Low battery is indicated by the symbol BAT on the display. Replace the battery as soon as possible after this symbol appears.

4.2 Over 9999 Reading Indication

If the numeric value for the display exceeds ± 9999 , with or without a decimal point, the display will blink and suppress the top (5th) digit, whilst continuing with correct values of the lower 4 digits.

4.3 Absolute or Gauge Measurement

C9550 Series instruments can be used with either gauge or absolute pressure transducers; no adjustment is required between use of either type. Refer to the transducer label to determine the measurement type. As the transducer only has a single port a direct differential measurement is not possible; in this case the zero function may be used between measurement from two transducers.

4.4 Error Messages

The following error messages may appear on the display to indicate incorrect operation or malfunction:

-00- Sensor not connected

-01- Overflow of A/D converter

-02- Overpressure (110% of Full Scale pressure)

-03- Mode not feasible

SCL Invalid Scale Units

- Error -00- indicates no sensor is connected.
- Error -01- occurs if connected transducer signal is too high (for example because of a transducer defect or a pressure overload).
- Error -02- indicates an attempt to measure a pressure (either positive or negative) that exceeds the range of the transducer by more than 10%. If this occurs the pressure must be reduced to avoid damage to the sensor in the transducer.

- Error -03- indicates either
 - a) an attempt to attach an incompatible sensor type.
 - b) an interrupted data transmission between sensor and instrument.
- Error SCL - indicates the scale units are not available on this transducer.

In the case of b) either reconnect the transducer or switch OFF then ON again. In the case of c) press the SCL key for the next supported scale units.

4.5 Battery Replacement

Unscrew the two screws at the base of the instrument and slide off the battery cover. Replace the battery with a 9V PP3 type battery. Replace the battery cover taking care not to over tighten the two screws.

5. UNITS OF MEASUREMENT

5.1 The C9550 Pressure Scaling System

Units other than the SI-units bar will be calculated by the C9550 using internationally agreed conversion factors. Once powered up the instrument will display values in the same scale as last selected. One or multiple depressions of the SCALE key will change the display to read other units of measurement.

For a given transducer, only those pressure scales with full scale numeric values less than 11,000 are available for selection; thus the lower pressure transducers have progressively more scales, to a maximum of 12 for the 0.1 bar transducer. The full display sequence of pressure scales is Kgcm⁻², mBar, Bar, inHg, Torr, inH₂O, kPa, Pa, mmHg, PSI, mmH₂O, mH₂O. For a complete listing of all scales and resolutions available for each pressure transducer, please consult the Comark Customer Service Department.

Because pressure scaling is a function of the transducer connected, the instrument automatically detects the transducer type at switch-on, or if a transducer is connected when the instrument is already switched on. This is known as 'hot swapping' when the full scale bar pressure is displayed for a period of 1.5 seconds to confirm proper detection of the new transducer.

The error message -03- is displayed either if the selected scale is not available with the attached transducer or if the valid transducer type was not detected. To clear the message reconnect the transducer and/or press the scale key.

5.2 Calibration Scale

A ± 500.0 mV scale for checking instrument calibration may be reached by holding down the SCL key when switching ON. This scale is cancelled by switching the instrument OFF. The units displayed for this scale are simply shown as 'm'. Details of a suitable calibration lead may be obtained from the Comark Customer Service Department.

1 bar =	Unit	Conversion Factor
	mbar	1000
	inHg	29.530
	Torr	750.06
	inH ₂ O	401.46
	kPa	100
	Pa	100000
	mmHg	750.06
	psi	14.5038
	mmH ₂ O	10197.2
	mH ₂ O	10.1972
	kgcm ⁻²	1.01972

Table 3. Scale Conversion Factors from 1 bar.

5.3 Table of Full Scale Pressures and Resolutions

Scale	FS,bar	2.500	6.000	9.999	9.99	400.0
mBar	Range	2500	6000	<u>10000</u>	NS	NS
	Resolution	1	1	1		
Bar	Range	2.500	6.000	<u>10.000</u>	<u>100.00</u>	400.0
	Resolution	0.001	0.001	0.001	0.01	0.01
inHg	Range	73.82	177.2	295.3	2953	NS
	Resolution	0.01	0.1	0.1	1	
Torr	Range	1875	4500	7501	NS	NS
	Resolution	1	1	1		
inH₂O	Range	<u>1003.7</u>	2409	4015	NS	NS
	Resolution	0.1	1	1		
kPa	Range	250.0	600.0	<u>1000.0</u>	<u>10000</u>	NS
	Resolution	0.1	0.1	0.1	1	
Pa	Range	NS	NS	NS	NS	NS
	Resolution					
mmHg	Range	1875	4500	7501	NS	NS
	Resolution	1	1	1		
PSI	Range	36.26	87.02	145.0	145.0	5802
	Resolution	0.01	0.01	0.1	1	1
mmH₂O	Range	NS	NS	NS	NS	NS
	Resolution					
mH₂O	Range	25.49	61.18	<u>101.97</u>	<u>1019.7</u>	4079
	Resolution	0.01	0.01	0.01	0.1	1
Kgcm⁻²	Range	2.549	6.118	<u>10.197</u>	<u>101.97</u>	407.9
	Resolution	0.001	0.001	0.001	0.01	0.1

Table 4. Full scale pressures and resolutions

Notes about table 4:

- The bold FS, bar value listed appears on display at power-on when the ON button is held.
- Key: NS = No Scale.
- Underline means this digit is absent, and the remaining digits blink.

A full 24 range, 12 scale tabular listing is available from Comark as Engineering Note 18.

6. Optional Equipment

Transducer interface cable, ADP22.

This is available from Comark Limited.
See Section 7 for the wiring of the interface cable.

Pressure transducers

These are not supplied with the instrument, and can be ordered from the wide range available from Comark Limited. For details of all ranges, 0.1 to 4000 bar refer to the Transducer Range Data Sheet, Ref: C089 or contact Comark Limited. Each internal diaphragm transducer is supplied complete with one G1/2-W gasket.

Transducer interface cable, ADP22.

This is available from Comark Limited.
See Section 7 for the wiring of the interface cable.

Pressure transducers

These are not supplied with the instrument, and can be ordered from the wide range available from Comark Limited. For details of all ranges, 0.1 to 4000 bar refer to the Transducer Range Data Sheet, Ref: C089 or contact Comark Limited. Each internal diaphragm transducer is supplied complete with one G1/2-W gasket.

Adaptor G $\frac{1}{2}$ A female to to G $\frac{1}{4}$ A male, ADP23

This is supplied complete with one G1/4-W gasket. Comark do not supply any other adaptors. If you require adaptors other than ADP23, these should be sourced locally.

Transducer gaskets

These are required in order to obtain a seal. Copper gaskets may be used up to 3 times, O-ring gaskets may be used repeatedly, and comprise:

G1/2-W	Copper gasket for G $\frac{1}{2}$ A
G1/4-W	Copper gasket for G $\frac{1}{4}$ A
G1/2-OW	O-ring gasket for G $\frac{1}{2}$ A.

7. WIRING OF INTERFACE CABLE

The standard interface cable has a length of 1.5 metres which is adequate for normal use. For greater lengths two cables may be joined end to end as the plug on one can be connected to the socket on the next. Alternatively cables up to 5 metres may be made by the user.

Wiring of interface cable

Plug Pin	Socket Pin	Wire Colour	Signal Function
1	1	Black	Data I/O
2	2	Brown	Serial Clock
3	3	Red	-
4	4	Orange	Chip Select
5	5	Yellow	+ supply
6	6	Green	+ signal
7	7	Blue	- supply
8	8	Purple	- signal

8. INSTRUMENT SPECIFICATION

CALIBRATED ACCURACY at +23°C	±0.06% of reading± 1 digit
TEMPERATURE COEFFICIENT OF READING	<0.01% of reading per °C change from 23°C
RESPONSE TIME	4 readings per second
OPERATING RANGE	-20 to +50°C
ENVIRONMENTAL RATING	IP67
POWER SOURCE	9V PP3 6F22 - MN1604 UCAR9V
BATTERY LIFE	140 hours (using MN1604)
LOW BAT CHECK	Displays BAT just before end point of battery
DISCONNECTED TRANSDUCER INDICATION	- 0 0 -
OVER PRESSURE INDICATION	- 0 2 -
OVER 9999 READING INDICATION	Lowest 4 digits blink
CONNECTIONS	8 way Lumberg socket KFV81 Mating plug, Lumberg SV81
OVERALL DIMENSIONS	Height 173mm, Width 70/83mm, Depth 32mm
WEIGHT	255 gm including battery

Declaration of Conformity

We:

Comark Limited
Bury Mead Road
Hitchin
Herts
SG5 1RT

Declare that the product:

Comark C9550

Is in conformity with the requirements of the following documents (Directives):

EMC Directive 2004/108/EEC

Standards:
EN61326-1:2006

Signed on behalf of
Comark Limited

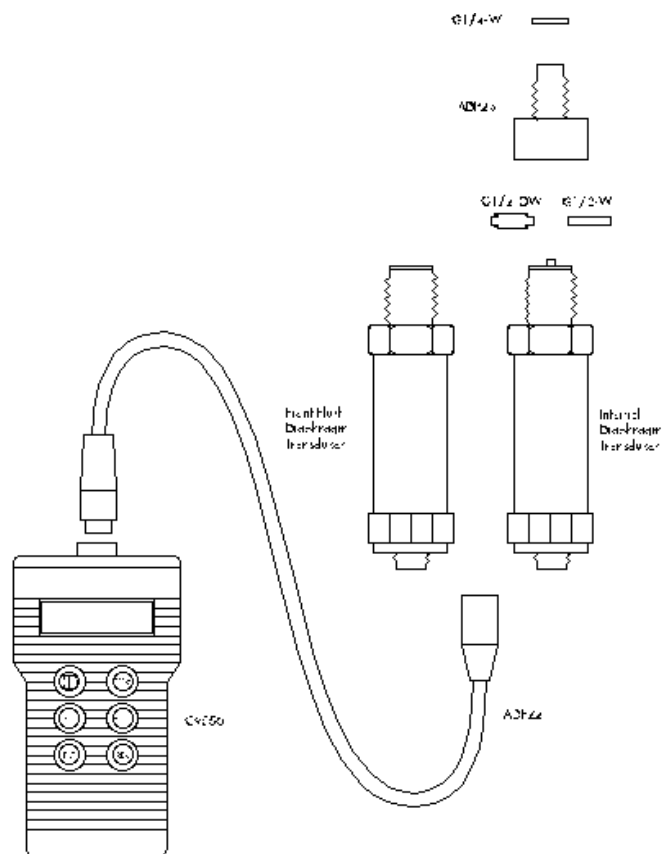
at:



David French
Quality Manager

Bury Mead Road
Hitchin
Herts
SG5 1RT

Fig. 1 View of the complete measurement system.



Comark Limited
52 Hurricane Way
Norwich, Norfolk, NR6 6JB England
Tel: 01603 (+44 1603) 256647
Fax: 01603 (+44 1603) 256744
Email: service@comarkltd.com

Website: www.comarkltd.com

Comark Instruments
PO Box 9090, Everett,
WA 98206, USA
Tel: (503) 643 5204
Fax: (503) 644 5859
Email: sales@comarkUSA.com

Website: www.comarkUSA.com