ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

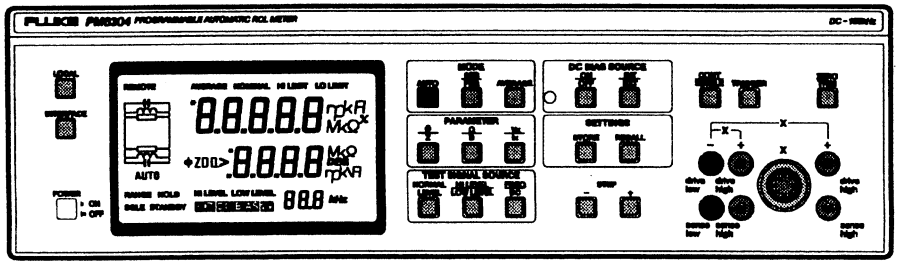
Find the *Fluke PM6304/023* at our website: *Click HERE*

Programmable Automatic RCL Meter

PM6304

Reference Manual

4822 872 10166
November 1995, Rev. 2, 02/99



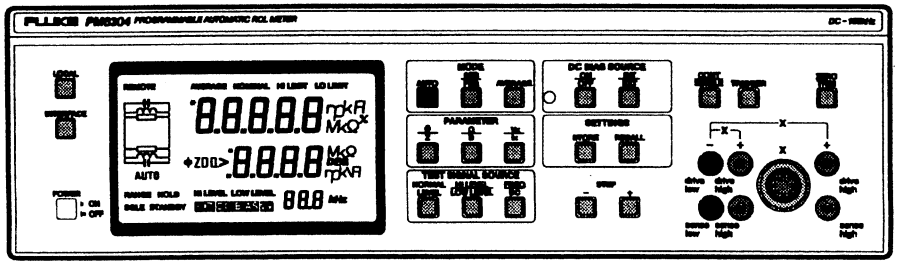
FLUKE.

Programmable Automatic RCL Meter

PM6304

Reference Manual

4822 872 10166
November 1995, Rev. 2, 02/99



FLUKE.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Please note
In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

Bitte beachten
Bei Schriftwechsel über dieses Gerät wird gebeten, die Typennummer und die Gerätenummer anzugeben. Diese befinden sich auf dem Typenschild an der Rückseite des Gerätes.

Noter s.v.p.
Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez toujours indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

Important
As the instrument is an electrical apparatus, it may be operated only by trained personnel. Maintenance and repairs may also be carried out only by qualified personnel.

Wichtig
Da das Gerät ein elektrisches Betriebsmittel ist, darf die Bedienung nur durch eingewiesenes Personal erfolgen. Wartung und Reparatur dürfen nur von geschultem, fach- und sachkundigem Personal durchgeführt werden.

Important
Comme l'instrument est un équipement électrique, le service doit être assuré par du personnel qualifié. De même, l'entretien et les réparations sont à confier aux personnes suffisamment qualifiées.

© Fluke Corporation. All rights reserved. Printed in Germany
All product names are trademarks of their respective companies.

Please note
In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

Bitte beachten
Bei Schriftwechsel über dieses Gerät wird gebeten, die Typennummer und die Gerätenummer anzugeben. Diese befinden sich auf dem Typenschild an der Rückseite des Gerätes.

Noter s.v.p.
Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez toujours indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

Important
As the instrument is an electrical apparatus, it may be operated only by trained personnel. Maintenance and repairs may also be carried out only by qualified personnel.

Wichtig
Da das Gerät ein elektrisches Betriebsmittel ist, darf die Bedienung nur durch eingewiesenes Personal erfolgen. Wartung und Reparatur dürfen nur von geschultem, fach- und sachkundigem Personal durchgeführt werden.

Important
Comme l'instrument est un équipement électrique, le service doit être assuré par du personnel qualifié. De même, l'entretien et les réparations sont à confier aux personnes suffisamment qualifiées.

© Fluke Corporation. All rights reserved. Printed in Germany
All product names are trademarks of their respective companies.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

GENERAL

The **PM6304 Programmable Automatic RCL Meter** belongs to the 0.1%-basic-accuracy class. The **PM6304C Programmable Automatic RCL Meter** has a higher accuracy of 0.05 % at test signal frequencies up to 2 kHz. Due to automatic ranging and display functions, the instruments feature fast measurement and diagnosis of two-pole electronic devices, e.g. passive two-pole components. The CUT (Component Under Test) is connected to the instrument in 4-wire technique by Kelvin contacts. Measurements are performed at one of 204 selectable test frequencies in the 50 Hz to 100 kHz range, using one of three selectable test voltages.

In the 'AUTO' mode, the large-area backlit LCD simultaneously shows the values of the dominant and the secondary parameter of the CUT, for example, the inductance and the series resistance of a lossy coil. A scheme of the equivalent circuit gives information at a glance about the main parameters of the CUT. Additionally the test frequency and status indications of the instrument, for example, 'SINGLE STANDBY' for the triggered SINGLE MODE, are displayed.

In the 'SECONDARY PARAMETER SELECTED' mode the non-dominant secondary parameter, for example the quality figure Q or the impedance Z, is selected by special parameter keys.

Installed options add extra test capabilities to the basic instrument:

- Equipped with the optional PM 9565 DC Unit, the instrument can perform dc resistance measurements.
- Via the optional PM 9548 IEEE-488 Interface or the PM 9549 RS-232 Interface, the instrument can be completely controlled for all settings and interrogated for these and all measuring data. Additionally, through the RS-232 Interface the measuring results sequentially can be sent directly to a printer for creating a test protocol.
- The PM 9559 Bin Programmer, a hand-held IR controller, and the PM 9566 Handler Interface are provided for the binning mode of the instrument.

PM6304 GENERAL – 1 –

GENERAL

The PM6304 Programmable Automatic RCL Meter belongs to the 0.1%-basic-accuracy class. The PM6304C Programmable Automatic RCL Meter has a higher accuracy of 0.05 % at test signal frequencies up to 2 kHz. Due to automatic ranging and display functions, the instruments feature fast measurement and diagnosis of two-pole electronic devices, e.g. passive two-pole components. The CUT (Component Under Test) is connected to the instrument in 4-wire technique by Kelvin contacts. Measurements are performed at one of 204 selectable test frequencies in the 50 Hz to 100 kHz range, using one of three selectable test voltages.

In the 'AUTO' mode, the large-area backlit LCD simultaneously shows the values of the dominant and the secondary parameter of the CUT, for example, the inductance and the series resistance of a lossy coil. A scheme of the equivalent circuit gives information at a glance about the main parameters of the CUT. Additionally the test frequency and status indications of the instrument, for example, 'SINGLE STANDBY' for the triggered SINGLE MODE, are displayed.

In the 'SECONDARY PARAMETER SELECTED' mode the non-dominant secondary parameter, for example the quality figure Q or the impedance Z, is selected by special parameter keys.

Installed options add extra test capabilities to the basic instrument:

- Equipped with the optional PM 9565 DC Unit, the instrument can perform dc resistance measurements.
- Via the optional PM 9548 IEEE-488 Interface or the PM 9549 RS-232 Interface, the instrument can be completely controlled for all settings and interrogated for these and all measuring data. Additionally, through the RS-232 Interface the measuring results sequentially can be sent directly to a printer for creating a test protocol.
- The PM 9559 Bin Programmer, a hand-held IR controller, and the PM 9566 Handler Interface are provided for the binning mode of the instrument.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- The 4-wire connection of the CUT is achieved by test posts on the front side of the instrument, by the optional PM 9541A 4-wire test cable, or by the PM 9542A RCL Adapter.
- For surface-mounted components the PM 9542SMD, SMD Adapter or the PM9540/TWE, SMD Tweezers can be used.
- The PM 2272 Inspector, a versatile PC software package, provides a comfortable user interface for statistical analysis and additional processing of cumulated instrument measuring data. Inspector also allows all instrument functions to be remote-controlled from the PC. Test results can be stored on disk, printed out in report form, or exported to spreadsheet programs.

– 2 – GENERAL PM6304

- The 4-wire connection of the CUT is achieved by test posts on the front side of the instrument, by the optional PM 9541A 4-wire test cable, or by the PM 9542A RCL Adapter.
- For surface-mounted components the PM 9542SMD, SMD Adapter or the PM9540/TWE, SMD Tweezers can be used.
- The PM 2272 Inspector, a versatile PC software package, provides a comfortable user interface for statistical analysis and additional processing of cumulated instrument measuring data. Inspector also allows all instrument functions to be remote-controlled from the PC. Test results can be stored on disk, printed out in report form, or exported to spreadsheet programs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

CONTENTS

		Page
1	**CHARACTERISTICS**	**1 – 1**
1.1	SAFETY AND EMC REQUIREMENTS	1 – 1
1.2	PERFORMANCE SPECIFICATION	1 – 2
1.3	POWER SUPPLY	1 – 9
1.4	ENVIROMENTAL CONDITIONS	1 – 10
1.5	SAFETY & QUALITY DATA, CABINET	1 – 12
1.6	OPTIONS, ACCESSORIES	1 – 13
2	**PRINCIPLE OF OPERATION**	**2 – 1**
2.1	INTRODUCTION	2 – 1
2.2	DESCRIPTION OF THE BLOCK DIAGRAM	2 – 2
2.3	BLOCK DIAGRAM	2 – 5
3	**BRIEF CHECKING PROCEDURE**	**3 – 1**
3.1	GENERAL	3 – 1
3.2	SELF-TEST ROUTINE	3 – 1
3.3	FUNCTIONAL TEST	3 – 2
4	**PERFORMANCE TEST**	**4 – 1**
4.1	INTRODUCTION	4 – 1
4.2	RECOMMENDED TEST EQUIPMENT	4 – 1
4.3	SELF-TEST ROUTINE	4 – 2
4.4	PERFORMANCE VERIFICATION	4 – 3
4.4.1	Test Signal Voltage	4 – 3
4.4.2	Test Signal Frequency	4 – 4
4.4.3	Open-Circuit Trimming	4 – 4
4.4.4	Short-Circuit Trimming	4 – 4
4.4.5	AC Measurements	4 – 5
4.4.6	DC Measurements	4 – 7

PM6304 CONTENTS – 1 –

CONTENTS

1 CHARACTERISTICS 1 – 1
1.1 SAFETY AND EMC REQUIREMENTS 1 – 1
1.2 PERFORMANCE SPECIFICATION 1 – 2
1.3 POWER SUPPLY 1 – 9
1.4 ENVIROMENTAL CONDITIONS 1 – 10
1.5 SAFETY & QUALITY DATA, CABINET 1 – 12
1.6 OPTIONS, ACCESSORIES 1 – 13
2 PRINCIPLE OF OPERATION 2 – 1
2.1 INTRODUCTION 2 – 1
2.2 DESCRIPTION OF THE BLOCK DIAGRAM 2 – 2
2.3 BLOCK DIAGRAM 2 – 5
3 BRIEF CHECKING PROCEDURE 3 – 1
3.1 GENERAL 3 – 1
3.2 SELF-TEST ROUTINE 3 – 1
3.3 FUNCTIONAL TEST 3 – 2
4 PERFORMANCE TEST 4 – 1
4.1 INTRODUCTION 4 – 1
4.2 RECOMMENDED TEST EQUIPMENT 4 – 1
4.3 SELF-TEST ROUTINE 4 – 2
4.4 PERFORMANCE VERIFICATION 4 – 3
4.4.1 Test Signal Voltage 4 – 3
4.4.2 Test Signal Frequency 4 – 4
4.4.3 Open-Circuit Trimming 4 – 4
4.4.4 Short-Circuit Trimming 4 – 4
4.4.5 AC Measurements 4 – 5
4.4.6 DC Measurements 4 – 7

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5 PREVENTIVE MAINTENANCE 5 – 1
5.1 GENERAL INFORMATION 5 – 1
5.2 SELF DIAGNOSTIC 5 – 1
5.3 RECALIBRATION 5 – 8

APPENDIX
Fig. 1 Maximum Charged-Capacitor Voltage – 1 –
Fig. 2 Error Limits for AC, NORMAL LEVEL – 2 –
Fig. 3 Error Limits for AC, HIGH LEVEL – 3 –
Fig. 4 Error Limits for AC, LOW LEVEL – 4 –
Fig. 5 Error Limits for DC Measurements – 5 –

SERVICE CENTERS

– 2 – CONTENTS PM6304

5 PREVENTIVE MAINTENANCE 5 – 1
5.1 GENERAL INFORMATION 5 – 1
5.2 SELF DIAGNOSTIC 5 – 1
5.3 RECALIBRATION 5 – 8

APPENDIX
Fig. 1 Maximum Charged-Capacitor Voltage – 1 –
Fig. 2 Error Limits for AC, NORMAL LEVEL – 2 –
Fig. 3 Error Limits for AC, HIGH LEVEL – 3 –
Fig. 4 Error Limits for AC, LOW LEVEL – 4 –
Fig. 5 Error Limits for DC Measurements – 5 –

SERVICE CENTERS

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 1

CHARACTERISTICS

Chapter 1

CHARACTERISTICS

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1 CHARACTERISTICS

1.1 SAFETY AND EMC REQUIREMENTS

The PM6304 Programmable Automatic RCL Meter 100 kHz is

in accordance with EN 61010–1 (safety requirements),
an electrical instrument for measurement and test including accessories
- intended for indoor use.
- Overvoltage Category II, Pollution Degree 2

in accordance with EN 55011 (radio interference suppression),
an ISM equipment (industrial, scientific, and medical RF-equipment)
- of Group I,
  which intentionally generates and/or uses conductively coupled radio frequency energy which is necessary for the internal functioning of the equipment itself.
- of Class B,
  suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

in accordance with EN 50082-1 (radio frequency immunity)
an instrument for use in all locations which
- are characterized by being supplied directly at low voltage from the public mains.
- are considered to be residential, commercial or light-industrial, both indoor and outdoor.

PM6304 CHARACTERISTICS 1 – 1

1 CHARACTERISTICS

1.1 SAFETY AND EMC REQUIREMENTS

The PM6304 Programmable Automatic RCL Meter 100 kHz is

in accordance with EN 61010–1 (safety requirements),
an electrical instrument for measurement and test including accessories
- intended for indoor use.
- Overvoltage Category II, Pollution Degree 2

in accordance with EN 55011 (radio interference suppression),
an ISM equipment (industrial, scientific, and medical RF-equipment)
- of Group I,
  which intentionally generates and/or uses conductively coupled radio frequency energy which is necessary for the internal functioning of the equipment itself.
- of Class B,
  suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

in accordance with EN 50082-1 (radio frequency immunity)
an instrument for use in all locations which
- are characterized by being supplied directly at low voltage from the public mains.
- are considered to be residential, commercial or light-industrial, both indoor and outdoor.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.2 PERFORMANCE SPECIFICATION

Properties expressed in numerical values with stated tolerance are guaranteed by the manufacturer. Specified non-tolerance values indicate those that could be nominally expected from the mean of a range of identical instruments. This specification is valid after the instrument has warmed up for 5 minutes and for reference conditions; see Section 1.4.

CUT PARAMETERS (CUT = Component Under Test)	R Resistance C Capacitance L Inductance Q Quality factor D Dissipation factor Z Impedance Φ Phase angle V CUT voltage I CUT current	Total ranges for specified accuracy, see Pages 1 – 6 and 1 – 7; for AUTO mode the dominant and the secondary parameter R, C, or L automatically are displayed; other secondary parameters are selectable by corresponding parameter keys.
CIRCUIT MODES	Series or parallel selectable	
TEST FREQUENCY	DC, 50 Hz, 60 Hz, 100 Hz, 120 Hz, 200 Hz to 20 kHz in 100 Hz steps, 100 kHz; selectable	DC only for instruments equipped with a DC Unit
	200 Hz to 20 kHz in 200 Hz steps; 100 kHz	For FAST MODE
▪ **Error limits**	±0.01 % 0.023 % ±0.01 %	Exclusive for 10.9 kHz For 10.9 kHz

1 – 2 CHARACTERISTICS PM6304

1.2 PERFORMANCE SPECIFICATION

Properties expressed in numerical values with stated tolerance are guaranteed by the manufacturer. Specified non-tolerance values indicate those that could be nominally expected from the mean of a range of identical instruments. This specification is valid after the instrument has warmed up for 5 minutes and for reference conditions; see Section 1.4.

CUT PARAMETERS (CUT = Component Under Test)
R Resistance
C Capacitance
L Inductance
Q Quality factor
D Dissipation factor
Z Impedance
Φ Phase angle
V CUT voltage
I CUT current
Total ranges for specified accuracy, see Pages 1 – 6 and 1 – 7; for AUTO mode the dominant and the secondary parameter R, C, or L automatically are displayed; other secondary parameters are selectable by corresponding parameter keys.

CIRCUIT MODES
Series or parallel selectable

TEST FREQUENCY
DC, 50 Hz, 60 Hz, 100 Hz, 120 Hz, 200 Hz to 20 kHz in 100 Hz steps, 100 kHz; selectable
DC only for instruments equipped with a DC Unit

200 Hz to 20 kHz in 200 Hz steps; 100 kHz
For FAST MODE

▪ Error limits
±0.01 %
0.023 % ±0.01 %
Exclusive for 10.9 kHz
For 10.9 kHz

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

AC TEST VOLTAGE rms	1 V via 100 Ω 2 V via 400 Ω 50 mV via 100 Ω	NORMAL LEVEL HI LEVEL LOW LEVEL, selectable by level keys
DC TEST VOLTAGE	1 V via 100 Ω 2 V via 400 Ω 0.3 V via 100 Ω	NORMAL LEVEL HI LEVEL LOW LEVEL selectable by level keys
▪ **Error limits**		
of source voltage	± 2 % for AC ±10 % for AC ± 4 % for DC	f ≤ 20 kHz f = 100 kHz
of int. resistance	± 1 %	
DC BIAS INTERNAL		For capacitors
▪ Voltage	2 V ±5 %	
▪ Charge time typ.	14 ms x (0.6 + 0.01 x C/mF)	For exceeding 1.6 V, or for falling below 0.4 V.
	≤60 ms 2.3 x 10^{-4} s x C/µF	For C ≤270 µF For C >270 µF For exceeding 95 % of final voltage.
DC BIAS EXTERNAL	0 to 40 V	Via 2 kΩ int. resistor
DISPLAY	Backlit LCD, simultaneous display of ▪ Dominant parameter ▪ Secondary parameter ▪ Equivalent circuit diagram ▪ Test frequency ▪ HI or LOW LEVEL, if selected ▪ Status indications, e.g., SGLE STANDBY	

PM6304 CHARACTERISTICS 1 – 3

AC TEST VOLTAGE rms	1 V via 100 Ω 2 V via 400 Ω 50 mV via 100 Ω	NORMAL LEVEL HI LEVEL LOW LEVEL, selectable by level keys
DC TEST VOLTAGE	1 V via 100 Ω 2 V via 400 Ω 0.3 V via 100 Ω	NORMAL LEVEL HI LEVEL LOW LEVEL selectable by level keys
▪ **Error limits**		
of source voltage	± 2 % for AC ±10 % for AC ± 4 % for DC	f ≤ 20 kHz f = 100 kHz
of int. resistance	± 1 %	
DC BIAS INTERNAL		For capacitors
▪ Voltage	2 V ±5 %	
▪ Charge time typ.	14 ms x (0.6 + 0.01 x C/mF)	For exceeding 1.6 V, or for falling below 0.4 V.
	≤60 ms 2.3 x 10^{-4} s x C/µF	For C ≤270 µF For C >270 µF For exceeding 95 % of final voltage.
DC BIAS EXTERNAL	0 to 40 V	Via 2 kΩ int. resistor
DISPLAY	Backlit LCD, simultaneous display of ▪ Dominant parameter ▪ Secondary parameter ▪ Equivalent circuit diagram ▪ Test frequency ▪ HI or LOW LEVEL, if selected ▪ Status indications, e.g., SGLE STANDBY	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OPERATIONAL MODES

RCL AUTO	Automatic measurement and display of the dominant and the secondary CUT parameter.
SECONDARY PARAMETER SELECTED	Automatic measurement and display of the dominant and the preselected secondary CUT parameter.
SERIES/PARALLEL	Selectable display of the series or parallel equivalent circuit and the corresponding CUT parameters.
BINNING	Measurement and display of the selected parameter and the programmed corresponding bin number in the presentation bin x with x = 0, 1, 2, ..., or 9.
AVERAGE ON	Exponential averaging of the displayed measuring values in CONT mode with increased time constant.
CONTinuous mode	Repetitive measurements and display updates.
SINGLE mode	One measurement and display update after triggering.
RANGE HOLD	Fixed measuring range and resolution via IEEE-488 or RS-232 Interface in SINGLE mode.
FAST mode	SINGLE mode with short measuring period for high data rates via IEEE-488 or RS-232 interface.
Restrictions	▪ Test frequencies DC, 200 Hz to 20 kHz in 200 Hz steps, 100 kHz. ▪ No measuring result display. ▪ Error limits are 10 times larger than those, specified for the other operational modes.

DISPLAY UPDATE RATE Typical about 2 per second

MEASURING PERIOD

- Typical display update period for CONT mode after 1st display
  for AC [1 + 10/(f/Hz)] x 0.42 s
  for DC 460 ms
- Typical display update period for RANGE HOLD in SINGLE mode Same as above

1 – 4 CHARACTERISTICS PM6304

OPERATIONAL MODES

RCL AUTO Automatic measurement and display of the dominant and the secondary CUT parameter.

SECONDARY PARAMETER SELECTED Automatic measurement and display of the dominant and the preselected secondary CUT parameter.

SERIES/PARALLEL Selectable display of the series or parallel equivalent circuit and the corresponding CUT parameters.

BINNING Measurement and display of the selected parameter and the programmed corresponding bin number in the presentation bin x with x = 0, 1, 2, ..., or 9.

AVERAGE ON Exponential averaging of the displayed measuring values in CONT mode with increased time constant.

CONTinuous mode Repetitive measurements and display updates.

SINGLE mode One measurement and display update after triggering.

RANGE HOLD Fixed measuring range and resolution via IEEE-488 or RS-232 Interface in SINGLE mode.

FAST mode SINGLE mode with short measuring period for high data rates via IEEE-488 or RS-232 interface.

Restrictions
- Test frequencies DC, 200 Hz to 20 kHz in 200 Hz steps, 100 kHz.
- No measuring result display.
- Error limits are 10 times larger than those, specified for the other operational modes.

DISPLAY UPDATE RATE Typical about 2 per second

MEASURING PERIOD
- Typical display update period for CONT mode after 1st display
  for AC [1 + 10/(f/Hz)] x 0.42 s
  for DC 460 ms
- Typical display update period for RANGE HOLD in SINGLE mode Same as above

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

▪ Additional time for SINGLE mode (without RANGE HOLD) or 1st CONT mode display	290 ms for Z ≥9.5 kΩ and f ≤300 Hz 70 ms else	
▪ Additional time for 60 Hz mains and for test frequencies 60 Hz and 120 Hz	70 ms	
▪ Measuring period for FAST mode	85 ms + 10 ms/(f/kHz)	
▪ Typical additional time for communication via IEEE-488 bus	25 ms for FAST mode	Including trigger, status interrogation, data transfer, array-element storage.
	120 ms for normal SINGLE mode	Additionally including clear status, parameter query, monitor display.

ZERO TRIM FUNCTION

Automatically performed after ZERO TRIM key actuation for compensation of
- The open-circuit adapter impedance, if it is >100 kΩ.
- The short-circuit adapter impedance, if it is <10 Ω.

COMPONENT CONNECTION

4-wire connection by Kelvin clips via
- Test posts, inserted into the frontpanel banana sockets.
- PM 9541A 4-WIRE TEST CABLE
- PM 9542A RCL ADAPTER
- PM 9542SMD, SMD ADAPTER

PM 9540/BAN 4-WIRE TEST CABLE with banana plugs.

2-wire connection by PM 9540/TWE, SMD TWEEZERS.

PM6304 CHARACTERISTICS 1 – 5

▪ Additional time for SINGLE mode (without RANGE HOLD) or 1st CONT mode display — 290 ms for Z ≥9.5 kΩ and f ≤300 Hz; 70 ms else

▪ Additional time for 60 Hz mains and for test frequencies 60 Hz and 120 Hz — 70 ms

▪ Measuring period for FAST mode — 85 ms + 10 ms/(f/kHz)

▪ Typical additional time for communication via IEEE-488 bus — 25 ms for FAST mode: Including trigger, status interrogation, data transfer, array-element storage.

120 ms for normal SINGLE mode: Additionally including clear status, parameter query, monitor display.

ZERO TRIM FUNCTION

Automatically performed after ZERO TRIM key actuation for compensation of
- The open-circuit adapter impedance, if it is >100 kΩ.
- The short-circuit adapter impedance, if it is <10 Ω.

COMPONENT CONNECTION

4-wire connection by Kelvin clips via
- Test posts, inserted into the frontpanel banana sockets.
- PM 9541A 4-WIRE TEST CABLE
- PM 9542A RCL ADAPTER
- PM 9542SMD, SMD ADAPTER

PM 9540/BAN 4-WIRE TEST CABLE with banana plugs.

2-wire connection by PM 9540/TWE, SMD TWEEZERS.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MAX. CONSTANT EXT. DC VOLTAGE/CURRENT

between terminals

- HI and LO 100 V/50 mA
- HI and ground 50 V/50 mA
- LOW and ground 0.5 V/500 mA

MAX. CHARGED CAPACITOR DC VOLTAGE

See Appendix, Figure 1

- For C <2 µF 500 V
- For 2 µF ≤C ≤2 mF 117 x $(C/mF)^{-0.234}$ V
- For C >2 mF 100 V

MEASURING ACCURACY

BASIC ERROR LIMITS ±0.1 % ±1 digit generally,
±0.5 % ±1 digit for AC/LOW LEVEL,
10-times larger for FAST mode
i.e., ±1 % ±1 digit generally,
±5 % ±1 digit for AC/LOW LEVEL

PM6304C has an higher accuracy of ±0.05 % ±1 digit in the frequency range 50 Hz to 2 kHz at NORMAL LEVEL; see Figure 2. Component connection not via PM 9541A 4-wire test cable or PM 9540/TWE, SMD Tweezers.
AVERAGE on in CONTinouos mode or mean value from 5 measurements in SINGLE mode.

PM6304 and PM6304C:
Hum interference may degrade measurement accuracy in FAST mode.

CONDITIONS FOR BASIC ERROR LIMITS

- Test frequency 50 Hz to 20 kHz — For 60 Hz and 120 Hz at 50 Hz AC mains and 50 Hz at 60 Hz AC mains hum interference may degrade measurement accuracy.
- Impedance range See Appendix, Figures 2, 3, 4, and 5; e.g., 1 Ω to 2 MΩ, 2 Ω to 4 MΩ, 3 Ω to 700 kΩ in the 300 Hz to 10 kHz range for NORMAL, HIGH, or LOW LEVEL.

1 – 6 CHARACTERISTICS PM6304

MAX. CONSTANT EXT. DC VOLTAGE/CURRENT
between terminals
- HI and LO 100 V/50 mA
- HI and ground 50 V/50 mA
- LOW and ground 0.5 V/500 mA

MAX. CHARGED CAPACITOR DC VOLTAGE
See Appendix, Figure 1
- For C <2 µF 500 V
- For 2 µF ≤C ≤2 mF 117 x $(C/mF)^{-0.234}$ V
- For C >2 mF 100 V

MEASURING ACCURACY

BASIC ERROR LIMITS ±0.1 % ±1 digit generally,
±0.5 % ±1 digit for AC/LOW LEVEL,
10-times larger for FAST mode
i.e., ±1 % ±1 digit generally,
±5 % ±1 digit for AC/LOW LEVEL

PM6304C has an higher accuracy of ±0.05 % ±1 digit in the frequency range 50 Hz to 2 kHz at NORMAL LEVEL; see Figure 2. Component connection not via PM 9541A 4-wire test cable or PM 9540/TWE, SMD Tweezers.
AVERAGE on in CONTinouos mode or mean value from 5 measurements in SINGLE mode.

PM6304 and PM6304C:
Hum interference may degrade measurement accuracy in FAST mode.

CONDITIONS FOR BASIC ERROR LIMITS
- Test frequency 50 Hz to 20 kHz — For 60 Hz and 120 Hz at 50 Hz AC mains and 50 Hz at 60 Hz AC mains hum interference may degrade measurement accuracy.
- Impedance range See Appendix, Figures 2, 3, 4, and 5; e.g., 1 Ω to 2 MΩ, 2 Ω to 4 MΩ, 3 Ω to 700 kΩ in the 300 Hz to 10 kHz range for NORMAL, HIGH, or LOW LEVEL.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- C range — According to impedance range, max. resolution 0.01 pF.
- L range — According to impedance range, max. resolution 0.01 µH.
- R_{DC} range — 4 Ω to 500 kΩ, NORMAL LEVEL
8 Ω to 1 MΩ, HIGH LEVEL
13 Ω to 150 kΩ, LOW LEVEL,
see Appendix, Figure 5,
max. resolution 5 digits, 0.1 mΩ.
- Used test fixture — See COMPONENT CONNECTION, 4-wire technique, page 1–5. PM 9541A 4-wire test cable for AC measurements at the high ohmic and low-ohmic ends only, if trimming is carefully performed with unchanged cable/Kelvin clips configuration.
- ZERO TRIM function — Executed with actually used test fixture at actual test frequency.
- D for R_{AC} measurement, Q for C measurement or L measurement — ≥ 1
- Ambient temperature — 0 to 50 °C
- Calibration — Performed within the calibration period.

GENERAL ACCURACY SPECIFICATION

RELATED TOTAL PARAMETER RANGES

- For R_{AC} and Z — 0.0000 Ω to 200 MΩ
- For R_{DC} — 0.0000 Ω to 50 MΩ
- For C — 0.00 pF to $(2 \pi f \times 0.1\ m\Omega)^{-1}$, e.g., 0 pF to 31.8 F at f = 50 Hz
- For L — 0.00 µH to 200 MΩ/(2 πf), e.g., 0 µH to 637 kH at f = 50 Hz
- For Q and D — 0.000 to 1000, or 0.000 to 200 for AC/LOW LEVEL
- For Φ — −90.0 deg to 0 to 90.0 deg
- For V — 0.1 µV to 2.00 V
- For I — 0.005 µA to 10.0 mA

PM6304 CHARACTERISTICS 1 – 7

- C range — According to impedance range, max. resolution 0.01 pF.
- L range — According to impedance range, max. resolution 0.01 µH.
- R_{DC} range — 4 Ω to 500 kΩ, NORMAL LEVEL
8 Ω to 1 MΩ, HIGH LEVEL
13 Ω to 150 kΩ, LOW LEVEL,
see Appendix, Figure 5,
max. resolution 5 digits, 0.1 mΩ.
- Used test fixture — See COMPONENT CONNECTION, 4-wire technique, page 1–5. PM 9541A 4-wire test cable for AC measurements at the high ohmic and low-ohmic ends only, if trimming is carefully performed with unchanged cable/Kelvin clips configuration.
- ZERO TRIM function — Executed with actually used test fixture at actual test frequency.
- D for R_{AC} measurement, Q for C measurement or L measurement — ≥ 1
- Ambient temperature — 0 to 50 °C
- Calibration — Performed within the calibration period.

GENERAL ACCURACY SPECIFICATION

RELATED TOTAL PARAMETER RANGES

- For R_{AC} and Z — 0.0000 Ω to 200 MΩ
- For R_{DC} — 0.0000 Ω to 50 MΩ
- For C — 0.00 pF to $(2 \pi f \times 0.1\ m\Omega)^{-1}$, e.g., 0 pF to 31.8 F at f = 50 Hz
- For L — 0.00 µH to 200 MΩ/(2 πf), e.g., 0 µH to 637 kH at f = 50 Hz
- For Q and D — 0.000 to 1000, or 0.000 to 200 for AC/LOW LEVEL
- For Φ — −90.0 deg to 0 to 90.0 deg
- For V — 0.1 µV to 2.00 V
- For I — 0.005 µA to 10.0 mA

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ERROR LIMITS

▪ For dominant R, C, L, or for Z	See Appendix, Figures 2, 3, 4 plus ±1 digit; in the following this error, derived from the figures, is referred as E.	
▪ For R_{DC}	See Appendix, Figure 5 plus ±1 digit	
▪ For secondary R (Q >1)	±E x Q ±1 digit	
▪ For secondary C or L (D > 1)	±E x D ±1 digit	
▪ For Q ≥1	±E x (1 + Q) ±1 digit	E = C or L error limit
▪ For D ≥1	±E x (1 + D) ±1 digit	E = R error limit
▪ For Φ	±1.2 E ±1 digit	E = dominant parameter error
▪ for V_{AC} 300 Hz to 20 kHz	± 3 % ±1 digit ±E	E = Z error, E = 0 for Z >10 kΩ
50 to 200 Hz, and 100 kHz	±15 % ±1 digit ±E	E = Z error, E = 0 for Z >10 kΩ
▪ For V_{DC}	± 5 % ±1 digit ±E	E = Z error, E = 0 for Z >10 kΩ
▪ For I_{AC} 300 Hz to 20 kHz	± 3 % ±1 digit ±E	E = Z error, E = 0 for Z <10 Ω
50 to 200 Hz, and 100 kHz	±15 % ±1 digit ±E	E = Z error, E = 0 for Z <10 Ω
▪ For I_{DC}	± 5 % ±1 digit ±E	E = Z error, E = 0 for Z <10 Ω
▪ For FAST mode	10-times larger than specified under the same conditions for normal speed.	

1 – 8 CHARACTERISTICS PM6304

ERROR LIMITS

▪ For dominant R, C, L, or for Z — See Appendix, Figures 2, 3, 4 plus ±1 digit; in the following this error, derived from the figures, is referred as E.

▪ For R_{DC} — See Appendix, Figure 5 plus ±1 digit

▪ For secondary R (Q >1) — ±E x Q ±1 digit

▪ For secondary C or L (D > 1) — ±E x D ±1 digit

▪ For Q ≥1 — ±E x (1 + Q) ±1 digit — E = C or L error limit

▪ For D ≥1 — ±E x (1 + D) ±1 digit — E = R error limit

▪ For Φ — ±1.2 E ±1 digit — E = dominant parameter error

▪ for V_{AC} 300 Hz to 20 kHz — ± 3 % ±1 digit ±E — E = Z error, E = 0 for Z >10 kΩ

50 to 200 Hz, and 100 kHz — ±15 % ±1 digit ±E — E = Z error, E = 0 for Z >10 kΩ

▪ For V_{DC} — ± 5 % ±1 digit ±E — E = Z error, E = 0 for Z >10 kΩ

▪ For I_{AC} 300 Hz to 20 kHz — ± 3 % ±1 digit ±E — E = Z error, E = 0 for Z <10 Ω

50 to 200 Hz, and 100 kHz — ±15 % ±1 digit ±E — E = Z error, E = 0 for Z <10 Ω

▪ For I_{DC} — ± 5 % ±1 digit ±E — E = Z error, E = 0 for Z <10 Ω

▪ For FAST mode — 10-times larger than specified under the same conditions for normal speed.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

CONDITIONS FOR GENERAL ACCURACY SPECIFITION

In regard of the test fixture, ZERO TRIM function, ambient temperature, and the calibration the same as for the basic error limits.

CALIBRATION PERIOD

1 year

BINNING

Total number of programmable bins	10, bin 0 to bin 9	Bin 0 used for an additional sorting condition.
Bin limits data entry	Absolute or relative	
Sorting method	Sequential or nested limits	

STORAGE REGISTERS

10 for complete instrument settings exclusive bin sets; register 0 is used for the actual settings and is automatically updated; all storage registers are nonvolatile.

10 for maximum 10 bin sets;
in register 0 the actually programmed bin set is saved, when switching over to binning or normal mode;
all storage registers are nonvolatile.

1.3 POWER SUPPLY

AC power

- Nominal voltage rms: 100 V, 120 V, 220 V, or 240 V selectable at power input connector.
- Reference voltage: 220 V ±2 %
- Voltage range and operating limits: ±10 % of nominal value
- Nominal frequency range: 50 to 60 Hz

PM6304 CHARACTERISTICS 1 – 9

CONDITIONS FOR GENERAL ACCURACY SPECIFITION

In regard of the test fixture, ZERO TRIM function, ambient temperature, and the calibration the same as for the basic error limits.

CALIBRATION PERIOD

1 year

BINNING

Total number of programmable bins	10, bin 0 to bin 9	Bin 0 used for an additional sorting condition.
Bin limits data entry	Absolute or relative	
Sorting method	Sequential or nested limits	

STORAGE REGISTERS

10 for complete instrument settings exclusive bin sets; register 0 is used for the actual settings and is automatically updated; all storage registers are nonvolatile.

10 for maximum 10 bin sets;
in register 0 the actually programmed bin set is saved, when switching over to binning or normal mode;
all storage registers are nonvolatile.

1.3 POWER SUPPLY

AC power

- Nominal voltage rms: 100 V, 120 V, 220 V, or 240 V selectable at power input connector.
- Reference voltage: 220 V ±2 %
- Voltage range and operating limits: ±10 % of nominal value
- Nominal frequency range: 50 to 60 Hz

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- Frequency operating limit range 47.5 to 63 Hz
- Power consumption 31 VA
- Power cable versions Alternatively supplied for
  - Universal Europe
  - North America
  - England (U.K.)
  - Switzerland
  - Australia

1.4 ENVIRONMENTAL CONDITIONS

Ambient temperature

- Reference range 0 °C to 50 °C (PM6304C: 23 °C ±5 K)
- Nominal operating range 0 °C to 50 °C
- storage and transport range −40 °C to 70 °C

Relative humidity

- Reference range 45 % to 75 %
- Nominal operating range 20 % to 80 %
- Limit range for use 10 % to 90 %
- Storage and transport range 0 % to 90 %

1 – 10 CHARACTERISTICS PM6304

- Frequency operating limit range 47.5 to 63 Hz
- Power consumption 31 VA
- Power cable versions Alternatively supplied for
  - Universal Europe
  - North America
  - England (U.K.)
  - Switzerland
  - Australia

1.4 ENVIRONMENTAL CONDITIONS

Ambient temperature

- Reference range 0 °C to 50 °C (PM6304C: 23 °C ±5 K)
- Nominal operating range 0 °C to 50 °C
- storage and transport range −40 °C to 70 °C

Relative humidity

- Reference range 45 % to 75 %
- Nominal operating range 20 % to 80 %
- Limit range for use 10 % to 90 %
- Storage and transport range 0 % to 90 %

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Air pressure	
▪ Reference value	1013 hPa
▪ Nominal operating range	800 to 1060 hPa
Air speed	
▪ Reference range	0 to 0.2 m/s
▪ Nominal operating range	0 to 0.5 m/s
Heat radiation	Direct sunlight radiation not allowed
Vibration	
▪ Limits for storage and transport	Max. amplitude 0.35 mm, max. acceleration 5 g (10 to 150 Hz)
Functional shock	MIL-T-28800D
▪ Acceleration	20 g
Operating position	Normally upright or flat with bow fold down
Warm-up time	5 minutes

PM6304 CHARACTERISTICS 1 – 11

Air pressure	
▪ Reference value	1013 hPa
▪ Nominal operating range	800 to 1060 hPa
Air speed	
▪ Reference range	0 to 0.2 m/s
▪ Nominal operating range	0 to 0.5 m/s
Heat radiation	Direct sunlight radiation not allowed
Vibration	
▪ Limits for storage and transport	Max. amplitude 0.35 mm, max. acceleration 5 g (10 to 150 Hz)
Functional shock	MIL-T-28800D
▪ Acceleration	20 g
Operating position	Normally upright or flat with bow fold down
Warm-up time	5 minutes

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.5 SAFETY & QUALITY DATA, CABINET

Safety	According to Low Voltage Directive 73/23/EEC, EN 61010–1 CAT II Pollution Degree 2, CSA 22.2 no. 231.
Protection type	IP 20 (IEC 529)
EMC	According to Electromagnetic Compatibility Directive 89/336/EEC. Emission according to EN 55 011, Group 1, Class B. Immunity according to EN 50 082-1, inclusive EN 61000–4–2, –3 and –4.
Call rate	<0.2 units per year
MTBF (calculated)	20,000 hours
Cabinet dimensions	▪ Width 315 mm (12.4”) ▪ Height 105 mm (4.13”) ▪ Depth 405 mm (15.9”) ▪ Weight 4.7 kg (10.4 lb)

1 – 12 CHARACTERISTICS PM6304

1.5 SAFETY & QUALITY DATA, CABINET

Safety	According to Low Voltage Directive 73/23/EEC, EN 61010–1 CAT II Pollution Degree 2, CSA 22.2 no. 231.
Protection type	IP 20 (IEC 529)
EMC	According to Electromagnetic Compatibility Directive 89/336/EEC. Emission according to EN 55 011, Group 1, Class B. Immunity according to EN 50 082-1, inclusive EN 61000–4–2, –3 and –4.
Call rate	<0.2 units per year
MTBF (calculated)	20,000 hours
Cabinet dimensions	▪ Width 315 mm (12.4”) ▪ Height 105 mm (4.13”) ▪ Depth 405 mm (15.9”) ▪ Weight 4.7 kg (10.4 lb)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.6 OPTIONS, ACCESSORIES

OPTIONS

PM 9548 IEEE-488 INTERFACE

Interface functions	AH1, SH1, L4, T6, RL1, SR1, C0, DC1, DT1, PP0, E2
Galvanical isolation	Opto-electronically
Instrument command set	See Users Manual or Programmers Manual.

PM 9549 RS-232 INTERFACE

Galvanical isolation	Opto-electronically
Instrument command set	Same as for PM 9548, see Users Manual or Programmers Manual.
Pre-setting parameters	
▪ Operating mode	Communication or printer mode
▪ transmission rate	110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19200 Baud
▪ Data bits	7 or 8
▪ Stop bits	1, 2 for 110 Baud
▪ Parity check	Odd, even or none (none for 8 data bits only)
▪ X_{ON}/X_{OFF} handshake	on or off
Hardware handshake	DSR/DTR and CTS/RTS
Connection	9-pin connector (instrument rear panel): 3 data wires inclusive ground 4 handshake wires

PM6304 CHARACTERISTICS 1 – 13

1.6 OPTIONS, ACCESSORIES

OPTIONS

PM 9548 IEEE-488 INTERFACE
Interface functions AH1, SH1, L4, T6, RL1, SR1, C0, DC1, DT1, PP0, E2
Galvanical isolation Opto-electronically
Instrument command set See Users Manual or Programmers Manual.

PM 9549 RS-232 INTERFACE
Galvanical isolation Opto-electronically
Instrument command set Same as for PM 9548, see Users Manual or Programmers Manual.
Pre-setting parameters
▪ Operating mode Communication or printer mode
▪ transmission rate 110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19200 Baud
▪ Data bits 7 or 8
▪ Stop bits 1, 2 for 110 Baud
▪ Parity check Odd, even or none (none for 8 data bits only)
▪ X_{ON}/X_{OFF} handshake on or off
Hardware handshake DSR/DTR and CTS/RTS
Connection 9-pin connector (instrument rear panel): 3 data wires inclusive ground 4 handshake wires

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PM 9565 DC UNIT For DC resistance (R_{DC}) measurements; specifications, see Section 1.2.

PM 9566 HANDLER INTERFACE

Connection: 15-pin connector at instrument rear panel

Galvanical isolation: Opto-electronically

Input

- Function: Trigger input for single measurements, especially for binning and FAST mode.
- Signal: Active-low TTL or short circuit to ground; pulse width >0.5 ms, for FAST mode >0.11 ms

Outputs: 11, for bin 0 to bin 9 and fail bin.

- Configuration: Open collector
- Switchable current: ≤200 mA
- Switchable voltage: ≤40 V (positive voltage)

1 – 14 CHARACTERISTICS PM6304

PM 9565 DC UNIT For DC resistance (R_{DC}) measurements; specifications, see Section 1.2.

PM 9566 HANDLER INTERFACE

Connection: 15-pin connector at instrument rear panel

Galvanical isolation: Opto-electronically

Input

- Function: Trigger input for single measurements, especially for binning and FAST mode.
- Signal: Active-low TTL or short circuit to ground; pulse width >0.5 ms, for FAST mode >0.11 ms

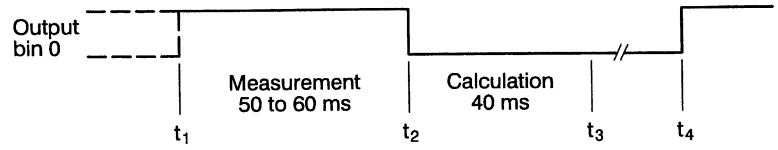
Outputs: 11, for bin 0 to bin 9 and fail bin.

- Configuration: Open collector
- Switchable current: ≤200 mA
- Switchable voltage: ≤40 V (positive voltage)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

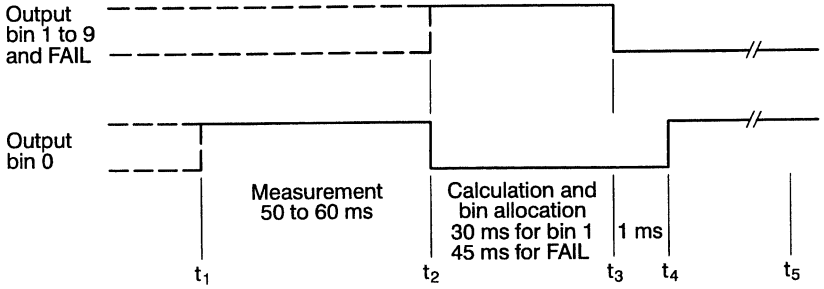
The output bin 0 provides a timing signal in FAST measurement mode

Timing Signal Bin 0 in FAST Mode



t_1 : Trigger starts measurement. Measurement time depends on test signal frequency and CUT; 50 to 60 ms at 1 kHz.
t_2 : End of measurement; CUT can be removed.
t_3 : Measurement result available.
t_4 : Trigger starts next measurement.

Timing Signal Bin 0 in FAST Mode during Binning

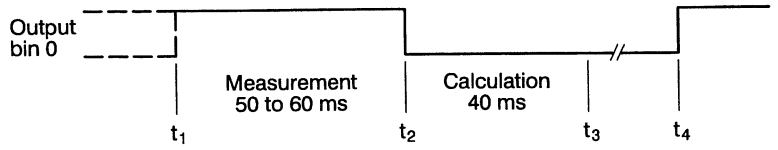


t_1 : Trigger starts measurement. Measurement time depends on test signal frequency and CUT; 50 to 60 ms at 1 kHz.
t_2 : End of measurement; CUT can be removed.
t_3 : Outputs bin 1 to 9 or FAIL are set.
t_4 : Outputs are valid; CUT can be handled according to the set bin.
t_5 : Trigger starts next measurement.

PM6304 CHARACTERISTICS 1 – 15

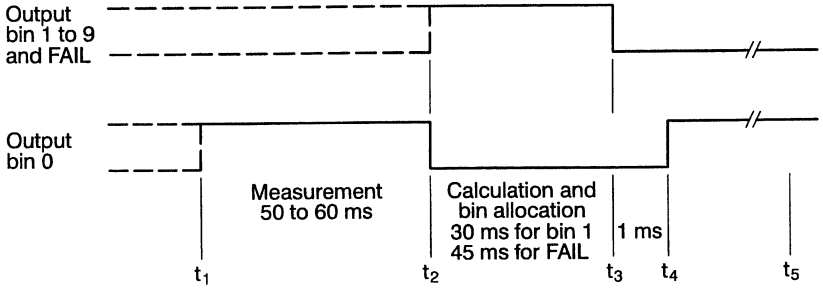
The output bin 0 provides a timing signal in FAST measurement mode

Timing Signal Bin 0 in FAST Mode



t_1 : Trigger starts measurement. Measurement time depends on test signal frequency and CUT; 50 to 60 ms at 1 kHz.
t_2 : End of measurement; CUT can be removed.
t_3 : Measurement result available.
t_4 : Trigger starts next measurement.

Timing Signal Bin 0 in FAST Mode during Binning



t_1 : Trigger starts measurement. Measurement time depends on test signal frequency and CUT; 50 to 60 ms at 1 kHz.
t_2 : End of measurement; CUT can be removed.
t_3 : Outputs bin 1 to 9 or FAIL are set.
t_4 : Outputs are valid; CUT can be handled according to the set bin.
t_5 : Trigger starts next measurement.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ACCESSORIES

STANDARD ACCESSORIES

- Power cable
- Fuses
- Test post red 5322 264 30351
- Test post black 5322 264 30352
- Users Manual 4822 872 10162
- Reference Manual 4822 872 10166

OPTIONAL ACCESSORIES

- PM 9540/BAN, 4-wire TEST CABLE with banana plugs
- PM 9540/TWE, SMD Tweezers
- PM 9541A, 4-wire TEST CABLE
- PM 9542A, RCL ADAPTER with 2 single test posts and 1 double test post
- PM 9542SMD, SMD ADAPTER
- PM 9536/041, 3 m RS-232 cable
- PM 2295/10, 1 m IEEE-488 BUS CABLE
- PM 2295/20, 2 m IEEE-488 BUS CABLE
- PM 9563, RACK MOUNT KIT (3E high)
- PM 9564, RACK MOUNT KIT (2E high)
- PM 2272, TEST SOFTWARE 'INSPECTOR'
- PM 9559, BIN PROGRAMMER
- Programmers Manual 4822 872 15169
- Service Manual 4822 872 15089
- Test Set 5322 310 32273

PM 9559 CHARACTERISTICS

- General description: Hand-held, battery operated IR controller for bin programming and binning mode switching on.
- Viewing angles onto the instrument (vs. front panel perpendicular);
  vertical operating range: −20 deg to 15 deg
  horizontal operating range: −18 deg to 18 deg
- Distance to PM6304 / PM6304C: <1.5 m (<6 feet)
- Battery: 9 V, DIN 40871, type 6F22G
- Supply current: Quiescent: 10 µA; Operating: ≤35 mA
- Ambient temperature
  – operating range: 0 to 50 °C
  – storage and transport range: −20 to 70 °C

1 – 16 CHARACTERISTICS PM6304

ACCESSORIES

STANDARD ACCESSORIES

- Power cable
- Fuses
- Test post red 5322 264 30351
- Test post black 5322 264 30352
- Users Manual 4822 872 10162
- Reference Manual 4822 872 10166

OPTIONAL ACCESSORIES

- PM 9540/BAN, 4-wire TEST CABLE with banana plugs
- PM 9540/TWE, SMD Tweezers
- PM 9541A, 4-wire TEST CABLE
- PM 9542A, RCL ADAPTER with 2 single test posts and 1 double test post
- PM 9542SMD, SMD ADAPTER
- PM 9536/041, 3 m RS-232 cable
- PM 2295/10, 1 m IEEE-488 BUS CABLE
- PM 2295/20, 2 m IEEE-488 BUS CABLE
- PM 9563, RACK MOUNT KIT (3E high)
- PM 9564, RACK MOUNT KIT (2E high)
- PM 2272, TEST SOFTWARE 'INSPECTOR'
- PM 9559, BIN PROGRAMMER
- Programmers Manual 4822 872 15169
- Service Manual 4822 872 15089
- Test Set 5322 310 32273

PM 9559 CHARACTERISTICS

- General description: Hand-held, battery operated IR controller for bin programming and binning mode switching on.
- Viewing angles onto the instrument (vs. front panel perpendicular);
  vertical operating range: −20 deg to 15 deg
  horizontal operating range: −18 deg to 18 deg
- Distance to PM6304 / PM6304C: <1.5 m (<6 feet)
- Battery: 9 V, DIN 40871, type 6F22G
- Supply current: Quiescent: 10 µA; Operating: ≤35 mA
- Ambient temperature
  – operating range: 0 to 50 °C
  – storage and transport range: −20 to 70 °C

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 2

PRINCIPLE OF OPERATION

Chapter 2

PRINCIPLE OF OPERATION

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2 PRINCIPLE OF OPERATION

2.1 INTRODUCTION

The two-pole CUT (Component Under Test) Zx is connected to the SELECTOR section of the instrument by four wires:

- Via the HD (High Drive) wire. The sinusoidal ac or the dc test voltage from the SOURCE or the DC source is routed to one CUT terminal by means of this wire.
- Via the LD (Low Drive) wire, which is forced electronically to near ground voltage level. The current through the CUT is routed by means of this wire either to the AC/V CONVERTER or, in the dc measuring mode, to the DC/V CONVERTER.
- By the HS (High Sense) and LS (Low Sense) wires, the voltages at the CUT terminals are picked up for processing.

In the dc-measuring mode, the sense voltages from the CUT and the DC/CONVERTER output voltages are converted to a 2 kHz ac voltage by the DC/AC CONVERTER in the DC UNIT. Within one measuring cycle, these voltages or, for the ac-measuring mode, the sense voltages from the CUT and the AC/V CONVERTER output voltage, are processed alternately in the AMPLIFIER-FILTER-MULTIPLYING DAC channel. In the DAC, the individual sinusoidal measuring voltage at A5 is multiplied successively by two quadrature-phase reference sine waves from the SIGNAL SYNTHESIZER, thus creating at A6 dc voltages proportional to the in-phase components of the measuring voltage. These dc terms are converted to binary numbers by a dual-slope ADC, consisting of the DUALSLOPE INTEGRATOR and the COUNTER, which are then read by the CPU. At the end of one measuring cycle in the ac measuring mode, seven numbers are normally in the CPU RAM:

- Two 'voltage numbers' for the two quadrature-phase components of the CUT voltage.
- Two 'current numbers' for the two quadrature-phase components of the CUT current.

PM6304 PRINCIPLE OF OPERATION 2 – 1

2 PRINCIPLE OF OPERATION

2.1 INTRODUCTION

The two-pole CUT (Component Under Test) Zx is connected to the SELECTOR section of the instrument by four wires:

- Via the HD (High Drive) wire. The sinusoidal ac or the dc test voltage from the SOURCE or the DC source is routed to one CUT terminal by means of this wire.
- Via the LD (Low Drive) wire, which is forced electronically to near ground voltage level. The current through the CUT is routed by means of this wire either to the AC/V CONVERTER or, in the dc measuring mode, to the DC/V CONVERTER.
- By the HS (High Sense) and LS (Low Sense) wires, the voltages at the CUT terminals are picked up for processing.

In the dc-measuring mode, the sense voltages from the CUT and the DC/CONVERTER output voltages are converted to a 2 kHz ac voltage by the DC/AC CONVERTER in the DC UNIT. Within one measuring cycle, these voltages or, for the ac-measuring mode, the sense voltages from the CUT and the AC/V CONVERTER output voltage, are processed alternately in the AMPLIFIER-FILTER-MULTIPLYING DAC channel. In the DAC, the individual sinusoidal measuring voltage at A5 is multiplied successively by two quadrature-phase reference sine waves from the SIGNAL SYNTHESIZER, thus creating at A6 dc voltages proportional to the in-phase components of the measuring voltage. These dc terms are converted to binary numbers by a dual-slope ADC, consisting of the DUALSLOPE INTEGRATOR and the COUNTER, which are then read by the CPU. At the end of one measuring cycle in the ac measuring mode, seven numbers are normally in the CPU RAM:

- Two 'voltage numbers' for the two quadrature-phase components of the CUT voltage.
- Two 'current numbers' for the two quadrature-phase components of the CUT current.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- One 'voltage reference' number for the main ac component of the CUT voltage measuring channel, short-circuited at the ac selector input.
- A 'current reference' number for the main ac component of the CUT current measuring channel, short-circuited at the ac selector input.
- A quadrature-phase 'voltage reference' or 'current reference' number, depending on the used larger amplifier gain.

These seven numbers, the appropriate amplifier gains and reference sine wave phases, the instrument trim and calibration data, all combine to form the basis for the calculation of the CUT parameters. This calculation is performed by the CPU according to pre-defined algorithms. The results are transferred to the display.

2.2 DESCRIPTION OF THE BLOCK DIAGRAM

SIGNAL SYNTHESIZER

The TWS (Triangle Wave Synthesizer) reads out sine wave tables loaded in the sine wave PROMs, and so creates 8-bit-word sequences of the test signal, the reference sine wave for the MULTIPLYING DAC and the DC/AC CONVERTER in the DC UNIT. The test signal is converted to an analog sine wave by the DAC. The CPU controls frequency and phase settings.

SOURCE

The test signal is filtered within the SOURCE section and set to the programmed high, normal or low level amplitude by the ac source. A bias regulator creates the dc current for fast biasing of tested capacitors. Overload protection circuits protect the test signal source and the bias source from being damaged by external load.

2 – 2 PRINCIPLE OF OPERATION PM6304

- One 'voltage reference' number for the main ac component of the CUT voltage measuring channel, short-circuited at the ac selector input.
- A 'current reference' number for the main ac component of the CUT current measuring channel, short-circuited at the ac selector input.
- A quadrature-phase 'voltage reference' or 'current reference' number, depending on the used larger amplifier gain.

These seven numbers, the appropriate amplifier gains and reference sine wave phases, the instrument trim and calibration data, all combine to form the basis for the calculation of the CUT parameters. This calculation is performed by the CPU according to pre-defined algorithms. The results are transferred to the display.

2.2 DESCRIPTION OF THE BLOCK DIAGRAM

SIGNAL SYNTHESIZER

The TWS (Triangle Wave Synthesizer) reads out sine wave tables loaded in the sine wave PROMs, and so creates 8-bit-word sequences of the test signal, the reference sine wave for the MULTIPLYING DAC and the DC/AC CONVERTER in the DC UNIT. The test signal is converted to an analog sine wave by the DAC. The CPU controls frequency and phase settings.

SOURCE

The test signal is filtered within the SOURCE section and set to the programmed high, normal or low level amplitude by the ac source. A bias regulator creates the dc current for fast biasing of tested capacitors. Overload protection circuits protect the test signal source and the bias source from being damaged by external load.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SELECTOR

The source resistor belonging to the selected test signal level is switched on by relays. The ac selector multiplexes the CUT voltage behind the sense buffer stages, the voltage from the AC/V CONVERTER and, for the reference measurements, the ground level. A differential amplifier pre-amplifies and buffers the multiplexed voltages in ac measuring mode. The AC/V CONVERTER converts the CUT current to a proportional ac voltage. The dc selector multiplexes the CUT terminal voltages and the voltage from the DC/V CONVERTER to the DC/AC CONVERTER in the DC UNIT. A bias selector inhibits the bias currents or routes either the EXTERNAL BIAS or the internal bias current from the SOURCE to the CUT.

DC UNIT

The DC voltage source, the DC/V CONVERTER for the CUT current and the DC/AC CONVERTER form the DC UNIT. The DC/AC CONVERTER converts the measuring voltages from the CUT terminals and the DC/V CONVERTER output voltage to a 2 kHz sine wave voltage. This is achieved by multiplication with the 2 kHz digital wave from the SIGNAL SYNTHESIZER.

AMPLIFIER

The preamplifier equalizes the amplitude differences, depending on the test signal level. The main amplifier-voltage divider channel is controlled by the CPU and set to such an overall gain. That at the output of the FILTER section, the window detector senses the in-range condition. For very low CUT voltages or currents, i.e., very low or very high CUT impedances, the corresponding gains are set to maximum.

FILTER

Depending on the selected test frequency, the AMPLIFIER output signal is filtered by a 300 Hz LPF, a 300 Hz to 20 kHz BPF, or a 100 kHz BPF. The output is buffered and sensed by the window detector (see Section AMPLIFIER).

PM6304 PRINCIPLE OF OPERATION 2 – 3

SELECTOR

The source resistor belonging to the selected test signal level is switched on by relays. The ac selector multiplexes the CUT voltage behind the sense buffer stages, the voltage from the AC/V CONVERTER and, for the reference measurements, the ground level. A differential amplifier pre-amplifies and buffers the multiplexed voltages in ac measuring mode. The AC/V CONVERTER converts the CUT current to a proportional ac voltage. The dc selector multiplexes the CUT terminal voltages and the voltage from the DC/V CONVERTER to the DC/AC CONVERTER in the DC UNIT. A bias selector inhibits the bias currents or routes either the EXTERNAL BIAS or the internal bias current from the SOURCE to the CUT.

DC UNIT

The DC voltage source, the DC/V CONVERTER for the CUT current and the DC/AC CONVERTER form the DC UNIT. The DC/AC CONVERTER converts the measuring voltages from the CUT terminals and the DC/V CONVERTER output voltage to a 2 kHz sine wave voltage. This is achieved by multiplication with the 2 kHz digital wave from the SIGNAL SYNTHESIZER.

AMPLIFIER

The preamplifier equalizes the amplitude differences, depending on the test signal level. The main amplifier-voltage divider channel is controlled by the CPU and set to such an overall gain. That at the output of the FILTER section, the window detector senses the in-range condition. For very low CUT voltages or currents, i.e., very low or very high CUT impedances, the corresponding gains are set to maximum.

FILTER

Depending on the selected test frequency, the AMPLIFIER output signal is filtered by a 300 Hz LPF, a 300 Hz to 20 kHz BPF, or a 100 kHz BPF. The output is buffered and sensed by the window detector (see Section AMPLIFIER).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MULTIPLYING DAC

The FILTER output signal is multiplied by the digital reference sine wave from the SIGNAL SYNTHESIZER. For the CUT voltage signal and the CUT current signal, two quadrature-phase reference signals are successively used (see introduction). The polarity detector provides the CPU with information about the right phase settings.

DUAL-SLOPE INTEGRATOR

The DUAL-SLOPE INTEGRATOR executes for each analog/digital conversion first, for a fixed period, the dc integration and then the de-integration to zero with a fixed dc input. This is always monitored by the timer within the COUNTER section and of the CPU. The reset & hold circuit sets the initial zero output voltage condition of the integrator.

COUNTER

During the de-integration period of the DUAL-SLOPE INTEGRATOR the COUNTER accumulates the number of the count-clock pulses. The final number, which is proportional to the integrated dc input, is read out by the CPU (see introduction). The timer controls the integration period of the DUAL-SLOPE INTEGRATOR. DUAL-SLOPE INTEGRATOR and COUNTER represent the dual-slope ADC.

CPU, LCD & KEYBOARD, IR DETECTOR

The instrument is operated from the KEYBOARD, or remoted by the IEEE-488 Interface or the RS-232 Interface, or via IR DETECTOR from the binning programmer. The CPU processes these instructions as well as the information from the window and the polarity detector for controlling the various functional units in the instrument. The computation results, derived from the measurement data, are transferred to the LCD, the HANDLER INTERFACE and the IEEE-488 Interface or the RS-232 Interface.

SUPPLY

The SUPPLY provides dc supply voltages for the various functional units in the instrument, a dc current for the LCD backlight and ac supply voltages for the IEEE-488 Interface or the RS-232 Interface, and the HANDLER INTERFACE. The data lines for the HANDLER INTERFACE are routed through the SUPPLY section.

2 – 4 PRINCIPLE OF OPERATION PM6304

MULTIPLYING DAC

The FILTER output signal is multiplied by the digital reference sine wave from the SIGNAL SYNTHESIZER. For the CUT voltage signal and the CUT current signal, two quadrature-phase reference signals are successively used (see introduction). The polarity detector provides the CPU with information about the right phase settings.

DUAL-SLOPE INTEGRATOR

The DUAL-SLOPE INTEGRATOR executes for each analog/digital conversion first, for a fixed period, the dc integration and then the de-integration to zero with a fixed dc input. This is always monitored by the timer within the COUNTER section and of the CPU. The reset & hold circuit sets the initial zero output voltage condition of the integrator.

COUNTER

During the de-integration period of the DUAL-SLOPE INTEGRATOR the COUNTER accumulates the number of the count-clock pulses. The final number, which is proportional to the integrated dc input, is read out by the CPU (see introduction). The timer controls the integration period of the DUAL-SLOPE INTEGRATOR. DUAL-SLOPE INTEGRATOR and COUNTER represent the dual-slope ADC.

CPU, LCD & KEYBOARD, IR DETECTOR

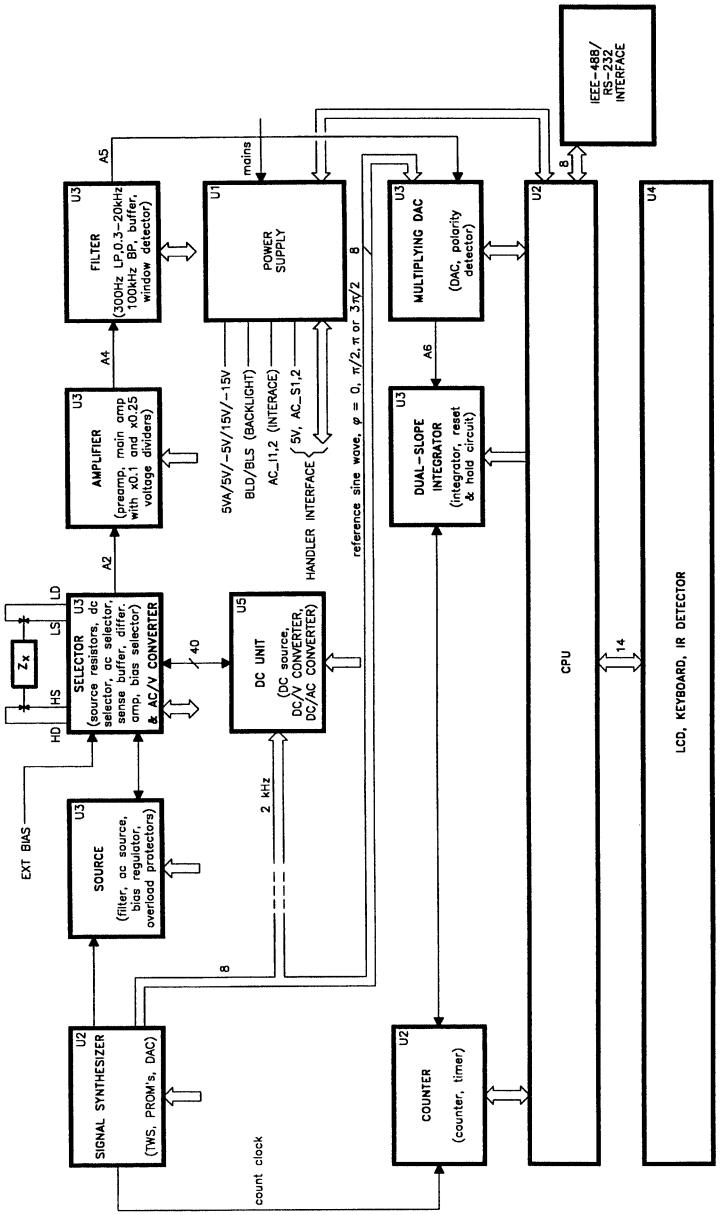
The instrument is operated from the KEYBOARD, or remoted by the IEEE-488 Interface or the RS-232 Interface, or via IR DETECTOR from the binning programmer. The CPU processes these instructions as well as the information from the window and the polarity detector for controlling the various functional units in the instrument. The computation results, derived from the measurement data, are transferred to the LCD, the HANDLER INTERFACE and the IEEE-488 Interface or the RS-232 Interface.

SUPPLY

The SUPPLY provides dc supply voltages for the various functional units in the instrument, a dc current for the LCD backlight and ac supply voltages for the IEEE-488 Interface or the RS-232 Interface, and the HANDLER INTERFACE. The data lines for the HANDLER INTERFACE are routed through the SUPPLY section.

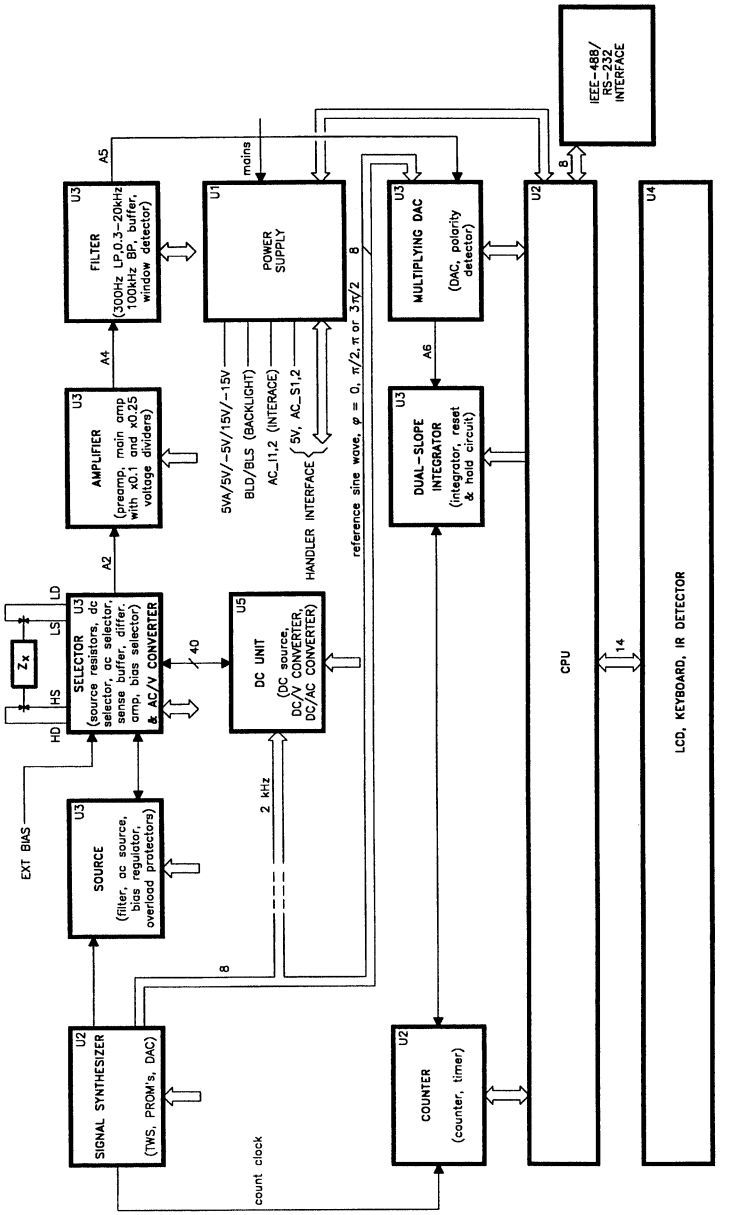
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.3 BLOCK DIAGRAM



PM6304 PRINCIPLE OF OPERATION 2 – 5

2.3 BLOCK DIAGRAM



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 3

BRIEF CHECKING PROCEDURE

Chapter 3

BRIEF CHECKING PROCEDURE

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3 BRIEF CHECKING PROCEDURE

3.1 GENERAL

This procedure checks the instrument functions with a minimum of steps. It is assumed that the operator doing the test is familiar with the instrument and its characteristics. Allow 5 minutes minimum warm-up time before starting the procedure.

WARNING

Before turning the instrument on, ensure that it has been installed in accordance with the instruction of the Users Manual, in Chapter 1.

3.2 SELF-TEST ROUTINE

After power on, the instrument performs a self-test of the PROM, processor RAM, and external RAM. After this the software version is indicated in the upper line of the display for approximately 1 second. All segments of the display field are shown for approximately 2 seconds and the instrument automatically recalls its instrument state before power off.

A possible fault is indicated as follows,

for example: 

For detailed information, see Pages 4–2 to 4–3.

PM6304 BRIEF CHECKING PROCEDURE 3 – 1

3 BRIEF CHECKING PROCEDURE

3.1 GENERAL

This procedure checks the instrument functions with a minimum of steps. It is assumed that the operator doing the test is familiar with the instrument and its characteristics. Allow 5 minutes minimum warm-up time before starting the procedure.

WARNING

Before turning the instrument on, ensure that it has been installed in accordance with the instruction of the Users Manual, in Chapter 1.

3.2 SELF-TEST ROUTINE

After power on, the instrument performs a self-test of the PROM, processor RAM, and external RAM. After this the software version is indicated in the upper line of the display for approximately 1 second. All segments of the display field are shown for approximately 2 seconds and the instrument automatically recalls its instrument state before power off.

A possible fault is indicated as follows,

for example: 

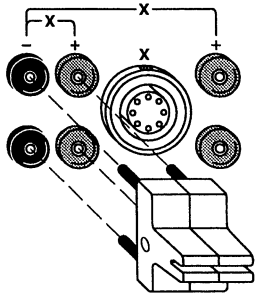
For detailed information, see Pages 4–2 to 4–3.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.3 FUNCTIONAL TEST

Immediately after power on a self-test routine is performed. Then the instrument automatically recalls measurement settings prior to the last power off.

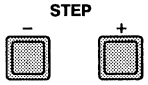
Insert the test posts supplied into the connector on the front panel (Logos face to face).



If the display shows **dc**, press the **FREQ DC** key.



Select an appropriate measurement frequency, for example, 1 kHz.



Press the green **AUTO** key.



The display shows:

AUTO

Press the **ZERO TRIM** key for 2 seconds.

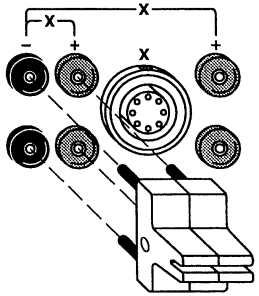


3 – 2 BRIEF CHECKING PROCEDURE PM6304

3.3 FUNCTIONAL TEST

Immediately after power on a self-test routine is performed. Then the instrument automatically recalls measurement settings prior to the last power off.

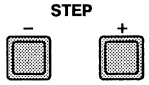
Insert the test posts supplied into the connector on the front panel (Logos face to face).



If the display shows **dc**, press the **FREQ DC** key.



Select an appropriate measurement frequency, for example, 1 kHz.



Press the green **AUTO** key.



The display shows:

AUTO

Press the **ZERO TRIM** key for 2 seconds.

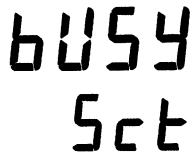


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

For open-circuit trimming the display shows:



For short-circuit trimming short circuit the test posts with a short wire or similar object and press the ZERO TRIM key; the display shows:



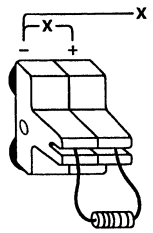
If the ZERO TRIM operation is unsuccessful, the diplay shows:
Refer to Users Manual, Section 4.7.



If the ZERO TRIM operation was successful, the diplay shows:

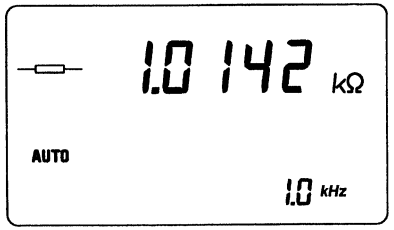


Insert a known component into the test posts, e.g., a 1 kΩ resistor.



The display shows:

When the display is correct the functional test is finished.

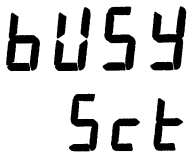


PM6304 BRIEF CHECKING PROCEDURE 3 – 3

For open-circuit trimming the display shows:



For short-circuit trimming short circuit the test posts with a short wire or similar object and press the ZERO TRIM key; the display shows:



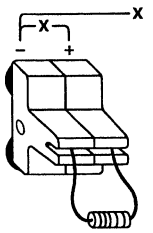
If the ZERO TRIM operation is unsuccessful, the diplay shows:
Refer to Users Manual, Section 4.7.



If the ZERO TRIM operation was successful, the diplay shows:

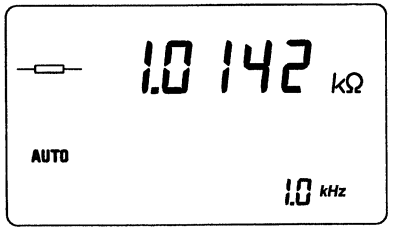


Insert a known component into the test posts, e.g., a 1 kΩ resistor.



The display shows:

When the display is correct the functional test is finished.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 4

PERFORMANCE TEST

Chapter 4

PERFORMANCE TEST

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4 PERFORMANCE TEST

4.1 INTRODUCTION

A performance test may be used as an acceptance test upon receipt of the instrument. If the test fails, an indication is given, that repair and/or adjustment is required.

The test procedure for the key parameters of the instrument refers to the Performance Specification in Chapter 1.

The PM6304 / PM6304C must be warmed up with all covers in place for at least 5 minutes before starting the tests.

4.2 RECOMMENDED TEST EQUIPMENT

AC rms Voltmeter	Fluke 8920A
DC Voltmeter	Philips PM 2535
Counter	Philips PM 6665

For performance verification in Section 4.4.1, the errors of these instruments must be taken into account.

2 Single Test Posts	Standard accessory
Test Set for PM6304, PM6304C, PM6306	5322 310 32273
If you only test PM6304 you can also use the **Test Set**	5322 310 32225

PM6304 PERFORMANCE TEST 4 – 1

4 PERFORMANCE TEST

4.1 INTRODUCTION

A performance test may be used as an acceptance test upon receipt of the instrument. If the test fails, an indication is given, that repair and/or adjustment is required.

The test procedure for the key parameters of the instrument refers to the Performance Specification in Chapter 1.

The PM6304 / PM6304C must be warmed up with all covers in place for at least 5 minutes before starting the tests.

4.2 RECOMMENDED TEST EQUIPMENT

AC rms Voltmeter Fluke 8920A
DC Voltmeter Philips PM 2535
Counter Philips PM 6665

For performance verification in Section 4.4.1, the errors of these instruments must be taken into account.

2 Single Test Posts Standard accessory

Test Set for PM6304, PM6304C, PM6306 5322 310 32273

If you only test PM6304 you can also use the Test Set 5322 310 32225

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Test Set 5322 310 32273

Component	Used for		Instrument Accuracy		Max. CUT Tolerance for Test	Component Value Value
	PM6304	PM6304C	PM6304/06	PM6304C		
R 1 Ω	●	●	±0.1 %	±0.1 %	±0.02 %	CV1
R 4 Ω	●	●	±0.1 %	±0.1 %	±0.02 %	CV2
R 100 Ω 1)	●	●	±0.1 %	±0.05 %	±0.005 %	CV3
R 1 kΩ		●	±0.1 %	±0.05 %	±0.01 %	CV4
R 10 kΩ 1)	●	●	±0.1 %	±0.05 %	±0.005 %	CV5
R 20 kΩ		●	±0.1 %	±0.05 %	±0.01 %	CV6
R 500 kΩ	●	●	±0.1 %	±0.1 %	±0.02 %	CV7
R 2 MΩ	●	●	±0.1 %	±0.1 %	±0.02 %	CV8
R 100 MΩ	●	●	±5 %	±5 %	±1 %	CV9
C 10 nF	●	●	±0.1 %	±0.05 %	±0.02 %	CV10

1) For these resistors tighter tolerances are necessary because they are also used for recalibration of the PM6304 and PM6304C.

The Test Set is supplied with the component values of the single components.
The specified component uncertainties are valid for f <10 kHz.
Because of component aging, it is necessary to measure the components after two years again.

4.3 SELF-TEST ROUTINE

After power on, the instrument checks the PROM, the processor RAM, and the external RAM. Additionally the instrument generates error messages if there are faults during measurements, trimming, recalibration or if there is a fault during data transfer to a printer.

Errors are indicated as follows:

Err 1 Program memory checksum error
Err 2 Processor RAM defective
Err 3 External RAM defective
Err 4 External RAM, backup (current instrument settings) destroyed
Err 5 External RAM, stored instrument settings 1 to 9 destroyed
Err 6 Error during analog to digital conversion of the test signal
Err 7 EEPROM defective

4 – 2 PERFORMANCE TEST PM6304

Test Set 5322 310 32273

1) For these resistors tighter tolerances are necessary because they are also used for recalibration of the PM6304 and PM6304C.

The Test Set is supplied with the component values of the single components.
The specified component uncertainties are valid for f <10 kHz.
Because of component aging, it is necessary to measure the components after two years again.

4.3 SELF-TEST ROUTINE

After power on, the instrument checks the PROM, the processor RAM, and the external RAM. Additionally the instrument generates error messages if there are faults during measurements, trimming, recalibration or if there is a fault during data transfer to a printer.

Errors are indicated as follows:

Err 1 Program memory checksum error
Err 2 Processor RAM defective
Err 3 External RAM defective
Err 4 External RAM, backup (current instrument settings) destroyed
Err 5 External RAM, stored instrument settings 1 to 9 destroyed
Err 6 Error during analog to digital conversion of the test signal
Err 7 EEPROM defective

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Err 8 Error in trim data (EEPROM)
Err 9 Error in calibration data (EEPROM)
Err 10 Error in binning data (EEPROM)
Err 11 Error during line frequency detection
Err 14 Test signal out of limits during trimming
Err 48 Communication error to the printer (time-out)

Errors 19 to 41 are errors during recalibration.
A detailed description is given in the Service Manual, Chapter 9.

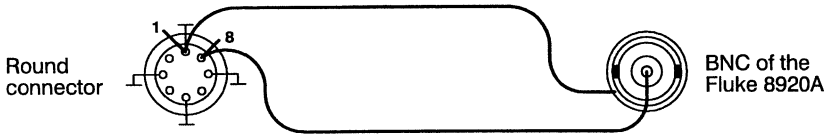
4.4 PERFORMANCE VERIFICATION

4.4.1 Test Signal Voltage

No component connected to PM6304.

Test equipment: AC rms Voltmeter, DC Voltmeter

- Set the PM6304 / PM6304C to AUTO and to DC BIAS OFF.
- Connect the AC rms voltmeter with tips to pin 8 (HIGH terminal) and pin 1 (circuit ground) of the round connector.
  Pin 1 must be connected to the outer part (ground) of the BNC connector of the voltmeter.



- Set frequency to 1 kHz.

Test result:
1 V ±20 mV (NORMAL LEVEL)
50 mV ± 1 mV (LOW LEVEL)
2 V ±40 mV (HIGH LEVEL)

PM6304 PERFORMANCE TEST 4 – 3

Err 8 Error in trim data (EEPROM)
Err 9 Error in calibration data (EEPROM)
Err 10 Error in binning data (EEPROM)
Err 11 Error during line frequency detection
Err 14 Test signal out of limits during trimming
Err 48 Communication error to the printer (time-out)

Errors 19 to 41 are errors during recalibration.
A detailed description is given in the Service Manual, Chapter 9.

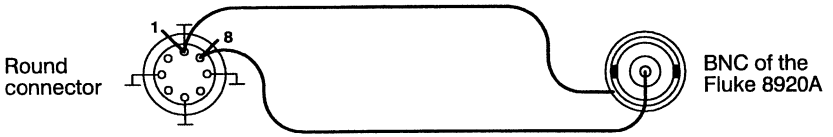
4.4 PERFORMANCE VERIFICATION

4.4.1 Test Signal Voltage

No component connected to PM6304.

Test equipment: AC rms Voltmeter, DC Voltmeter

- Set the PM6304 / PM6304C to AUTO and to DC BIAS OFF.
- Connect the AC rms voltmeter with tips to pin 8 (HIGH terminal) and pin 1 (circuit ground) of the round connector.
  Pin 1 must be connected to the outer part (ground) of the BNC connector of the voltmeter.



- Set frequency to 1 kHz.

Test result:
1 V ±20 mV (NORMAL LEVEL)
50 mV ± 1 mV (LOW LEVEL)
2 V ±40 mV (HIGH LEVEL)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- Connect DC Voltmeter to pin 8 and pin 1.
- Set test voltage to DC.

Test result: 1 V ±40 mV (NORMAL LEVEL)
0.3 V ±12 mV (LOW LEVEL)
2 V ±80 mV (HIGH LEVEL)

4.4.2 Test Signal Frequency

Test equipment: Counter

- Set counter to 1s gate time.
- Set PM6304 / PM6304C to 100 kHz test signal frequency.
- Connect counter with tips to pin 8 and pin 1.

Test result: 99.990 to 100.010 kHz

4.4.3 Open-Circuit Trimming

Insert the two single test posts into the two left positions and press the ZERO TRIM key.

Test result: The display shows BUSY and OCT, PASS, and about 0.0 pF finally.

4.4.4 Short-Circuit Trimming

Short the test posts by a clean wire, diameter approximately 1 mm, and press the ZERO TRIM key.

Test result: The display shows BUSY and SCT, PASS, and about 0.000 Ω finally.

If these tests are not performed accurately, the display shows FAIL instead of PASS. Please check the test conditions, and in doubt, repeat the procedure.

4 – 4 PERFORMANCE TEST PM6304

- Connect DC Voltmeter to pin 8 and pin 1.
- Set test voltage to DC.

Test result: 1 V ±40 mV (NORMAL LEVEL)
0.3 V ±12 mV (LOW LEVEL)
2 V ±80 mV (HIGH LEVEL)

4.4.2 Test Signal Frequency

Test equipment: Counter

- Set counter to 1s gate time.
- Set PM6304 / PM6304C to 100 kHz test signal frequency.
- Connect counter with tips to pin 8 and pin 1.

Test result: 99.990 to 100.010 kHz

4.4.3 Open-Circuit Trimming

Insert the two single test posts into the two left positions and press the ZERO TRIM key.

Test result: The display shows BUSY and OCT, PASS, and about 0.0 pF finally.

4.4.4 Short-Circuit Trimming

Short the test posts by a clean wire, diameter approximately 1 mm, and press the ZERO TRIM key.

Test result: The display shows BUSY and SCT, PASS, and about 0.000 Ω finally.

If these tests are not performed accurately, the display shows FAIL instead of PASS. Please check the test conditions, and in doubt, repeat the procedure.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4.4.5 AC Mesurements

For each test frequency perform open-circuit and short-circuit trimming.
At 100 kHz repeat trimming for each level.

Test Signal Frequency	Test Signal Level	Test Component	Test Result Requirement	
100 Hz	LOW	4 Ω	CV2 ±1.13 %	
	NORMAL		CV2 ±0.10 %	
	HIGH		CV2 ±0.15 %	
	LOW	500 kΩ	CV7 ±1.08 %	
	NORMAL		CV7 ±0.10 %	
	HIGH		CV7 ±0.10 %	
1 kHz	LOW	1 Ω	CV1 ±1.5 %	
	NORMAL		CV1 ±0.1 %	
	HIGH		CV1 ±0.2 %	
	LOW	4 Ω	CV2 ±0.5 %	
	NORMAL		CV2 ±0.1 %	
	HIGH		CV2 ±0.1 %	
	LOW	100 Ω	CV3 ±0.5 %	
	NORMAL		CV3 ±0.1 %	(PM6304)
	NORMAL		CV3 ±0.05 %	(PM6304C)
	HIGH		CV3 ±0.1 %	
	LOW	10 kΩ	CV5 ±0.5 %	
	NORMAL		CV5 ±0.1 %	(PM6304)
	NORMAL		CV5 ±0.05 %	(PM6304C)
	HIGH		CV5 ±0.1 %	
	LOW	500 kΩ	CV7 ±0.5 %	
	NORMAL		CV7 ±0.1 %	
	HIGH		CV7 ±0.1 %	
	LOW	2 MΩ 1)	CV8 ±1.43 %	
	NORMAL		CV8 ±0.1 %	
	HIGH		CV8 ±0.1 %	
	NORMAL	100 MΩ	CV9 ±5.0 %	
	HIGH		CV9 ±2.5 %	
	LOW	10 nF 2)	CV10 ±0.5 %	
	NORMAL		CV10 ±0.1 %	(PM6304)
	NORMAL		CV10 ±0.03 %	(PM6304C)
	HIGH		CV10 ±0.1 %	

PM6304 PERFORMANCE TEST 4 – 5

4.4.5 AC Mesurements

For each test frequency perform open-circuit and short-circuit trimming.
At 100 kHz repeat trimming for each level.

Test Signal Frequency	Test Signal Level	Test Component	Test Result Requirement	
100 Hz	LOW	4 Ω	CV2 ±1.13 %	
	NORMAL		CV2 ±0.10 %	
	HIGH		CV2 ±0.15 %	
	LOW	500 kΩ	CV7 ±1.08 %	
	NORMAL		CV7 ±0.10 %	
	HIGH		CV7 ±0.10 %	
1 kHz	LOW	1 Ω	CV1 ±1.5 %	
	NORMAL		CV1 ±0.1 %	
	HIGH		CV1 ±0.2 %	
	LOW	4 Ω	CV2 ±0.5 %	
	NORMAL		CV2 ±0.1 %	
	HIGH		CV2 ±0.1 %	
	LOW	100 Ω	CV3 ±0.5 %	
	NORMAL		CV3 ±0.1 %	(PM6304)
	NORMAL		CV3 ±0.05 %	(PM6304C)
	HIGH		CV3 ±0.1 %	
	LOW	10 kΩ	CV5 ±0.5 %	
	NORMAL		CV5 ±0.1 %	(PM6304)
	NORMAL		CV5 ±0.05 %	(PM6304C)
	HIGH		CV5 ±0.1 %	
	LOW	500 kΩ	CV7 ±0.5 %	
	NORMAL		CV7 ±0.1 %	
	HIGH		CV7 ±0.1 %	
	LOW	2 MΩ 1)	CV8 ±1.43 %	
	NORMAL		CV8 ±0.1 %	
	HIGH		CV8 ±0.1 %	
	NORMAL	100 MΩ	CV9 ±5.0 %	
	HIGH		CV9 ±2.5 %	
	LOW	10 nF 2)	CV10 ±0.5 %	
	NORMAL		CV10 ±0.1 %	(PM6304)
	NORMAL		CV10 ±0.03 %	(PM6304C)
	HIGH		CV10 ±0.1 %	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Test Signal Frequency	Test Signal Level	Test Component	Test Result Requirement
10 kHz	LOW	4 Ω	CV2 ±0.5 %
	NORMAL		CV2 ±0.1 %
	HIGH		CV2 ±0.1 %
	LOW	500 kΩ	CV7 ±0.5 %
	NORMAL		CV7 ±0.1 %
	HIGH		CV7 ±0.1 %
	LOW	10 nF 2)	CV10 ±0.5 %
	NORMAL		CV10 ±0.1 %
	HIGH		CV10 ±0.1 %
100 kHz	LOW	4 Ω	CV2 ±2.0 %
	NORMAL		CV2 ±0.4 %
	HIGH		CV2 ±0.4 %
	LOW	500 kΩ	CV7 ±2.0 %
	NORMAL		CV7 ±0.4 %
	HIGH		CV7 ±0.4 %

In addition for the instrument version **PM6304C:**

Test Signal Frequency	Test Signal Level	Test Component	Test Result Requirement
100 Hz	NORMAL	1 kΩ	CV4 ±0.05 %
300 Hz	NORMAL	20 kΩ	CV6 ±0.05 %
2 kHz	NORMAL	1 kΩ	CV4 ±0.05 %
2 kHz	NORMAL	20 kΩ	CV6 ±0.05 %

1) If you cannot meet the test results for the 2 MΩ resistor it might be that the test resistor has drifted from its labeled original value, because the resistor has a drift of max. <0.04 % in 3 years. Please check whether the resistor should be measured again.
2) If you cannot meet the test results for the 10 nF capacitor it might be that the test capacitor has drifted from its labeled original value. Please check whether the capacitor should be measured again.
The measurement uncertainty must be <0.02 %.
You can also order a new capacitor; code number 5322 126 13738.
The original measurement date is indicated on the bag for the capacitor.
The capacitance drift is specified to <0.2 % in 3 years.
According to our experience the drift is much lower: <0.04 % in 3 years.
There are no capacitors with lower drift at the low price of this capacitor on the market.
If you have access to a low-drift standard capacitor in your calibration laboratory or elsewhere, please make use of.

4 – 6 PERFORMANCE TEST PM6304

Test Signal Frequency	Test Signal Level	Test Component	Test Result Requirement
10 kHz	LOW	4 Ω	CV2 ±0.5 %
	NORMAL		CV2 ±0.1 %
	HIGH		CV2 ±0.1 %
	LOW	500 kΩ	CV7 ±0.5 %
	NORMAL		CV7 ±0.1 %
	HIGH		CV7 ±0.1 %
	LOW	10 nF 2)	CV10 ±0.5 %
	NORMAL		CV10 ±0.1 %
	HIGH		CV10 ±0.1 %
100 kHz	LOW	4 Ω	CV2 ±2.0 %
	NORMAL		CV2 ±0.4 %
	HIGH		CV2 ±0.4 %
	LOW	500 kΩ	CV7 ±2.0 %
	NORMAL		CV7 ±0.4 %
	HIGH		CV7 ±0.4 %

In addition for the instrument version **PM6304C:**

Test Signal Frequency	Test Signal Level	Test Component	Test Result Requirement
100 Hz	NORMAL	1 kΩ	CV4 ±0.05 %
300 Hz	NORMAL	20 kΩ	CV6 ±0.05 %
2 kHz	NORMAL	1 kΩ	CV4 ±0.05 %
2 kHz	NORMAL	20 kΩ	CV6 ±0.05 %

1) If you cannot meet the test results for the 2 MΩ resistor it might be that the test resistor has drifted from its labeled original value, because the resistor has a drift of max. <0.04 % in 3 years. Please check whether the resistor should be measured again.
2) If you cannot meet the test results for the 10 nF capacitor it might be that the test capacitor has drifted from its labeled original value. Please check whether the capacitor should be measured again.
The measurement uncertainty must be <0.02 %.
You can also order a new capacitor; code number 5322 126 13738.
The original measurement date is indicated on the bag for the capacitor.
The capacitance drift is specified to <0.2 % in 3 years.
According to our experience the drift is much lower: <0.04 % in 3 years.
There are no capacitors with lower drift at the low price of this capacitor on the market.
If you have access to a low-drift standard capacitor in your calibration laboratory or elsewhere, please make use of.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4.4.6 DC Measurements

(for instruments with DC Unit 5 only).

Test Signal Frequency	Test Signal Level	Test Component	Test Result Requirement
DC	LOW	1 Ω	CV1 ±1.30 %
	NORMAL		CV1 ±0.40 %
	HIGH		CV1 ±0.80 %
	LOW	4 Ω	CV2 ±0.33 %
	NORMAL		CV2 ±0.10 %
	HIGH		CV2 ±0.20 %
	LOW	10 kΩ	CV5 ±0.10 %
	NORMAL		CV5 ±0.10 %
	HIGH		CV5 ±0.10 %
	LOW	500 kΩ	CV7 ±0.33 %
	NORMAL		CV7 ±0.10 %
	HIGH		CV7 ±0.10 %
	LOW	2 MΩ	CV8 ±1.33 %
	NORMAL		CV8 ±0.40 %
	HIGH		CV8 ±0.20 %

PM6304 PERFORMANCE TEST 4 – 7

4.4.6 DC Measurements

(for instruments with DC Unit 5 only).

Test Signal Frequency	Test Signal Level	Test Component	Test Result Requirement
DC	LOW	1 Ω	CV1 ±1.30 %
	NORMAL		CV1 ±0.40 %
	HIGH		CV1 ±0.80 %
	LOW	4 Ω	CV2 ±0.33 %
	NORMAL		CV2 ±0.10 %
	HIGH		CV2 ±0.20 %
	LOW	10 kΩ	CV5 ±0.10 %
	NORMAL		CV5 ±0.10 %
	HIGH		CV5 ±0.10 %
	LOW	500 kΩ	CV7 ±0.33 %
	NORMAL		CV7 ±0.10 %
	HIGH		CV7 ±0.10 %
	LOW	2 MΩ	CV8 ±1.33 %
	NORMAL		CV8 ±0.40 %
	HIGH		CV8 ±0.20 %

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 5

PREVENTIVE MAINTENANCE

Chapter 5

PREVENTIVE MAINTENANCE

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5 PREVENTIVE MAINTENANCE

5.1 GENERAL INFORMATION

This instrument normally requires no maintenance, since none of its components is subject to wear.
However, to ensure reliable and trouble-free operation, the instrument should not be exposed to moisture, heat, corrosive elements or exessive dust.

5.2 SELF DIAGNOSTIC

In addition to the test during power on a test program is installed which checks the communication from the keyboard, the remote control interface, and the PM 9559 bin programmer as well as the data transfer to the internal memories.

The test program contains the following nine subprograms:

Pro 1	Display Test
Pro 2	Keyboard Test
Pro 3	Bin Programmer Test
Pro 4	Storage Register Test
Pro 5	EEPROM Test
Pro 6	Internal C-bus Test
Pro 7	Measurement Data Test
Pro 8	Calibration Data Test
Pro 9	Interface Test

Tests 6, 7, and 8 serve as an aid to the Service Technician for trouble shooting. Incircuit measurements with an open instrument are necessary; therefore, those tests are described in the Service Manual.

Press the **LOCAL** key, while turning the instrument on. After the power-on routine the letters ***tESt*** appear in the display, then the menu of subprograms Pro 1 to 9 appears. Press the **LOCAL** key briefly to select and carry out the test required. Press the **LOCAL** key again for about 1 second to return to the subprogram menu. To leave the test program, turn off the instrument.

PM6304 PREVENTIVE MAINTENANCE 5 – 1

5 PREVENTIVE MAINTENANCE

5.1 GENERAL INFORMATION

This instrument normally requires no maintenance, since none of its components is subject to wear.
However, to ensure reliable and trouble-free operation, the instrument should not be exposed to moisture, heat, corrosive elements or exessive dust.

5.2 SELF DIAGNOSTIC

In addition to the test during power on a test program is installed which checks the communication from the keyboard, the remote control interface, and the PM 9559 bin programmer as well as the data transfer to the internal memories.

The test program contains the following nine subprograms:

Pro 1 Display Test
Pro 2 Keyboard Test
Pro 3 Bin Programmer Test
Pro 4 Storage Register Test
Pro 5 EEPROM Test
Pro 6 Internal C-bus Test
Pro 7 Measurement Data Test
Pro 8 Calibration Data Test
Pro 9 Interface Test

Tests 6, 7, and 8 serve as an aid to the Service Technician for trouble shooting. Incircuit measurements with an open instrument are necessary; therefore, those tests are described in the Service Manual.

Press the **LOCAL** key, while turning the instrument on. After the power-on routine the letters ***tESt*** appear in the display, then the menu of subprograms Pro 1 to 9 appears. Press the **LOCAL** key briefly to select and carry out the test required. Press the **LOCAL** key again for about 1 second to return to the subprogram menu. To leave the test program, turn off the instrument.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Program 1: Display Test

The display test checks the liquid crystal display and the respective decoders/ drivers. When the text ***Pro I*** appears in the subprogram menu, press the **LOCAL** key. The text **REMOTE** appears. Press any key. All segments of the display are switched on one after the other. You can stop and release the test with any key. The instrument then waits with the total display lit up until you press the **LOCAL** key to return to the submenu or until you leave the test program.

Program 2: Keyboard Test

This test checks the function of each key as well as those of the keyboard encoder. Press the **LOCAL** key when the text ***Pro 2*** appears in the submenu; the display shows ***bCod***. If you press any key in random, the current number of this key appears in the display alone with a control number, for example, ***3–00*** when **AVERAGE** key is pressed. This control number is generated by the keyboard encoder and can be changed to ***00***, ***0I***, ***I0***, ***II*** by pressing this key again. The keys are numbered row by row from left to right. For example, the **ZERO TRIM** key has the number 8, and the **STORE** key has number 13.
To return to the subprogram menu, press the **LOCAL** key.

To leave the test program, turn off the instrument.

Program 3: Bin Programmer Test

This test checks the function of the infrared transmitter and receiver, the function of the keys, and the encoder.

Press the **LOCAL** key when the text ***Pro 3*** appears in the submenu; the display shows ***ICodE***. If you press any key of the bin programmer in random, the current number of this key appears in the display with a control number, for example, ***4–0*** when the key **BINNING** is pressed. This control number is generated by the encoder and can be toggled from ***I*** to ***0***. The keys are numbered row by row from left to right. For example, the **NOMINAL** key has the number 10, and the **RECALL** key has the number 37.
To return to the subprogram menu, press the **LOCAL** key.

To leave the test program, turn off the instrument.

5 – 2 PREVENTIVE MAINTENANCE PM6304

Program 1: Display Test

The display test checks the liquid crystal display and the respective decoders/ drivers. When the text Pro I appears in the subprogram menu, press the LOCAL key. The text REMOTE appears. Press any key. All segments of the display are switched on one after the other. You can stop and release the test with any key. The instrument then waits with the total display lit up until you press the LOCAL key to return to the submenu or until you leave the test program.

Program 2: Keyboard Test

This test checks the function of each key as well as those of the keyboard encoder. Press the LOCAL key when the text Pro 2 appears in the submenu; the display shows bCod. If you press any key in random, the current number of this key appears in the display alone with a control number, for example, 3–00 when AVERAGE key is pressed. This control number is generated by the keyboard encoder and can be changed to 00, 0I, I0, II by pressing this key again. The keys are numbered row by row from left to right. For example, the ZERO TRIM key has the number 8, and the STORE key has number 13.
To return to the subprogram menu, press the LOCAL key.

To leave the test program, turn off the instrument.

Program 3: Bin Programmer Test

This test checks the function of the infrared transmitter and receiver, the function of the keys, and the encoder.

Press the LOCAL key when the text Pro 3 appears in the submenu; the display shows ICodE. If you press any key of the bin programmer in random, the current number of this key appears in the display with a control number, for example, 4–0 when the key BINNING is pressed. This control number is generated by the encoder and can be toggled from I to 0. The keys are numbered row by row from left to right. For example, the NOMINAL key has the number 10, and the RECALL key has the number 37.
To return to the subprogram menu, press the LOCAL key.

To leave the test program, turn off the instrument.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Program 4: Memory Register Test

This test checks the memory for the storage of instrument settings and trim data (**ZERO TRIM**). The contents of this memory are not written over or deleted during the test and can be used as usual when the test has been completed.

The test runs automatically. The display shows ***rEG 0*** and shows ***PASS*** at the end of the test. If the test finds an error, the display shows ***Error***.
Press the **LOCAL** key to return to the subprogram menu.

To leave the test program, turn off the instrument.

Program 5: EEPROM Test

This test checks the function of the EEPROM. Press the **LOCAL** key when the text ***Pro 5*** appears. The test runs automatically. The contents of the memory is not overwritten or deleted during the test. The display shows ***EEPro*** and ***PASS*** at the end of the test. If the test finds an error the display shows ***Error***.
Press the **LOCAL** key to return to the subprogramm menu.

To leave the test program, turn off the instrument.

Program 9: Interface Test (RS-232 or IEEE-488)

This test checks the built-in interface, its inputs and output buffers, and the correct coding and decoding of the data transferred.

Press the **LOCAL** key when the text ***Pro 9*** appears. The test automatically checks which interface is actually available; if none, ***noBuS*** appears in the display and the instrument automatically returns to the menu of the test program. In instruments with interface, there is a choice between an input test (***IdAtA***), an output test (***OdAtA***), and a read-out of the device status (***StAt***). Selection is done by pressing any key (except **LOCAL**). For the IEEE-488 Interface, the device address is set to 20. The configuration for the RS-232 interface is: Baud rate 9600, data bits 8, parity no. Using the RS-232 Interface the instrument must be set to remote with ESC 2.

PM6304 PREVENTIVE MAINTENANCE 5 – 3

Program 4: Memory Register Test

This test checks the memory for the storage of instrument settings and trim data (**ZERO TRIM**). The contents of this memory are not written over or deleted during the test and can be used as usual when the test has been completed.

The test runs automatically. The display shows ***rEG 0*** and shows ***PASS*** at the end of the test. If the test finds an error, the display shows ***Error***.
Press the **LOCAL** key to return to the subprogram menu.

To leave the test program, turn off the instrument.

Program 5: EEPROM Test

This test checks the function of the EEPROM. Press the **LOCAL** key when the text ***Pro 5*** appears. The test runs automatically. The contents of the memory is not overwritten or deleted during the test. The display shows ***EEPro*** and ***PASS*** at the end of the test. If the test finds an error the display shows ***Error***.
Press the **LOCAL** key to return to the subprogramm menu.

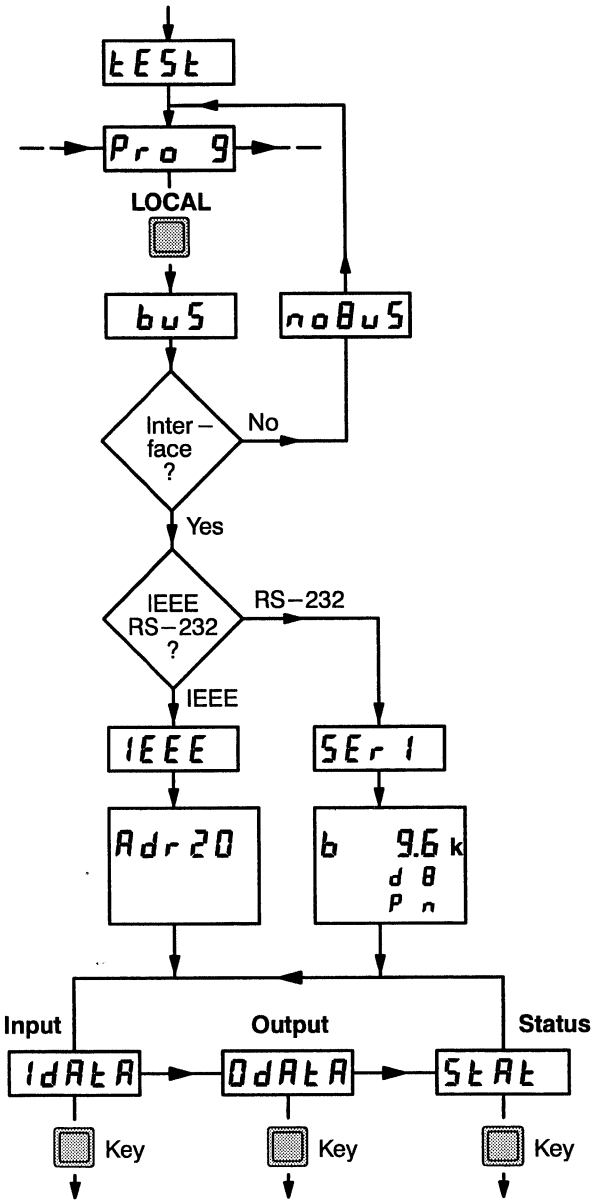
To leave the test program, turn off the instrument.

Program 9: Interface Test (RS-232 or IEEE-488)

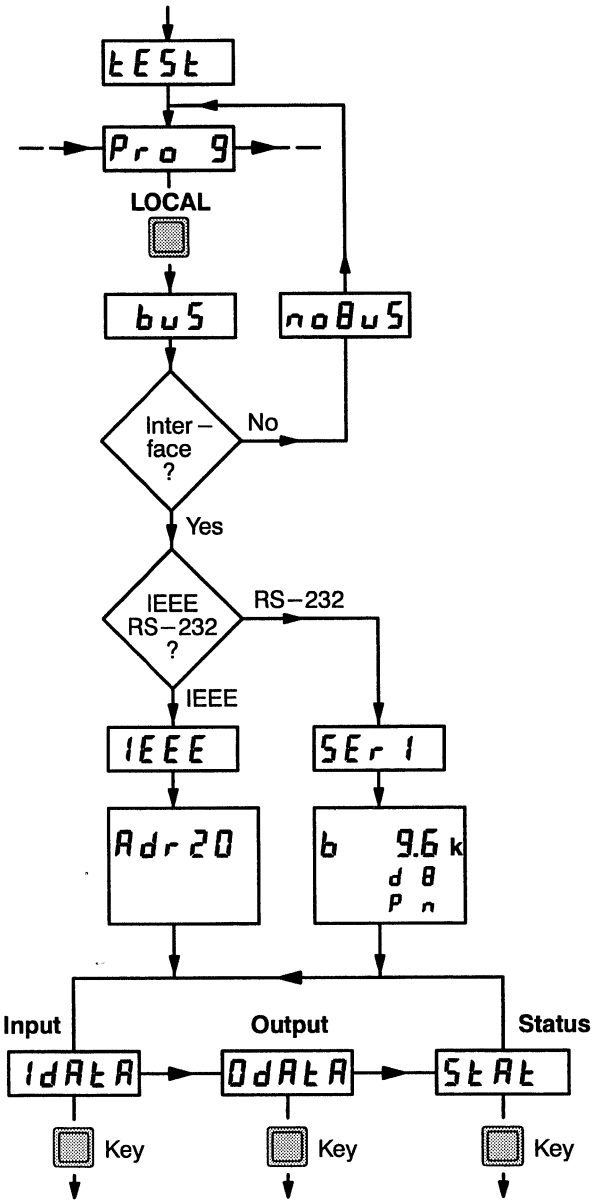
This test checks the built-in interface, its inputs and output buffers, and the correct coding and decoding of the data transferred.

Press the **LOCAL** key when the text ***Pro 9*** appears. The test automatically checks which interface is actually available; if none, ***noBuS*** appears in the display and the instrument automatically returns to the menu of the test program. In instruments with interface, there is a choice between an input test (***IdAtA***), an output test (***OdAtA***), and a read-out of the device status (***StAt***). Selection is done by pressing any key (except **LOCAL**). For the IEEE-488 Interface, the device address is set to 20. The configuration for the RS-232 interface is: Baud rate 9600, data bits 8, parity no. Using the RS-232 Interface the instrument must be set to remote with ESC 2.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

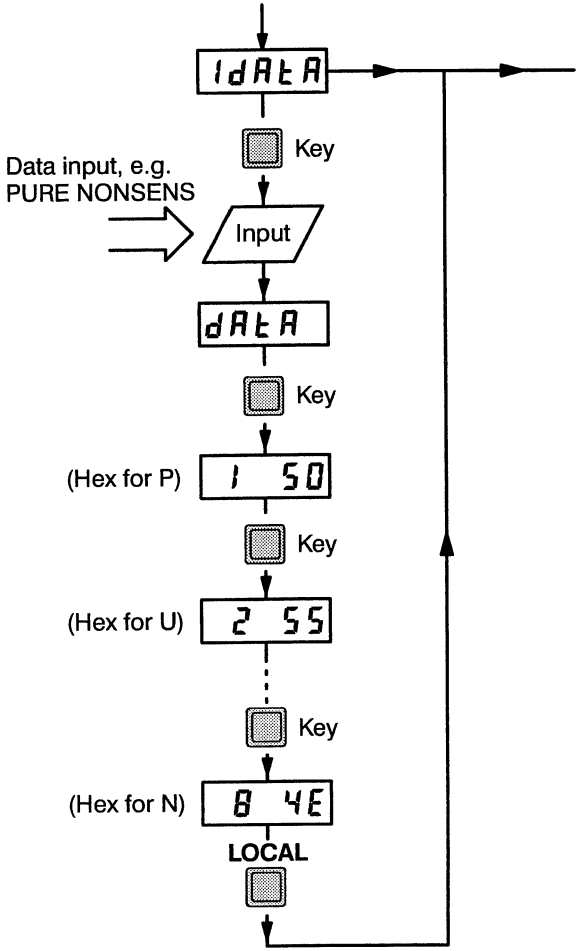


5 – 4 PREVENTIVE MAINTENANCE PM6304



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Test:
When the instrument received data via interface the display shows ***dAtA***. The first eight figures of the string can be displayed individually in hexadecimal form by pressing any key (except **LOCAL**). The data input can be repeated as often as desired.

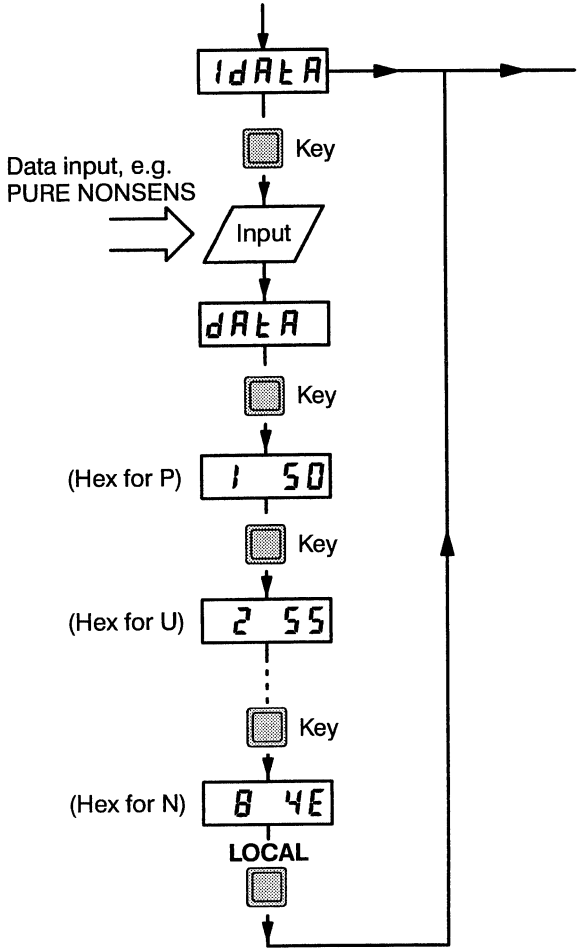


Press the **LOCAL** key to return to the selection between input, output, and status. Press the key again to return to the menu of the test program.

To leave the test program, turn off the instrument.

PM6304 PREVENTIVE MAINTENANCE 5 – 5

Input Test:
When the instrument received data via interface the display shows ***dAtA***. The first eight figures of the string can be displayed individually in hexadecimal form by pressing any key (except **LOCAL**). The data input can be repeated as often as desired.



Press the **LOCAL** key to return to the selection between input, output, and status. Press the key again to return to the menu of the test program.

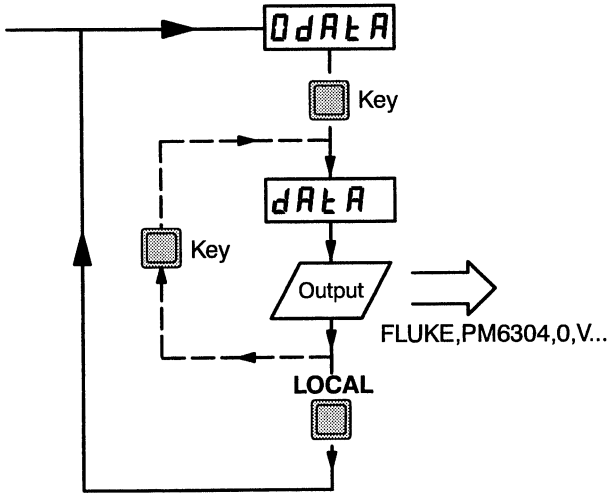
To leave the test program, turn off the instrument.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Test:
When the output test is selected the display shows ***dAtA*** and the identification string

'FLUKE,PM6304,0,Vx.x'

can be read out by a controller. This test can be repeated so often as desired by pressing any key (except **LOCAL**).



Press the **LOCAL** key to return to the selection between input, output, and status. Press the key again to return to the menu of the test program.

To leave the test program, turn off the instrument.

Device-Status Test:
This test checks the data transfer from the instrument to the Standard Event Status Register and to the Status Byte Register.

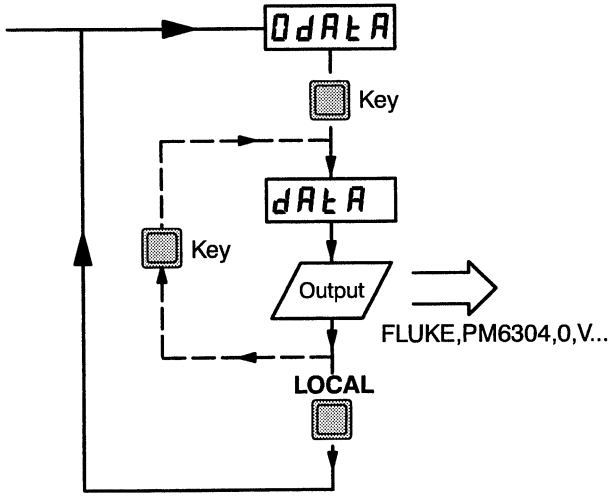
Pressing any key (except **LOCAL**) when the display shows ***StAt*** sets the bits of the Standard Event Status Register (ESR) to 1 or 0. The display shows ***StAt 0*** or ***StAt I***.

5 – 6 PREVENTIVE MAINTENANCE PM6304

Output Test:
When the output test is selected the display shows ***dAtA*** and the identification string

'FLUKE,PM6304,0,Vx.x'

can be read out by a controller. This test can be repeated so often as desired by pressing any key (except **LOCAL**).



Press the **LOCAL** key to return to the selection between input, output, and status. Press the key again to return to the menu of the test program.

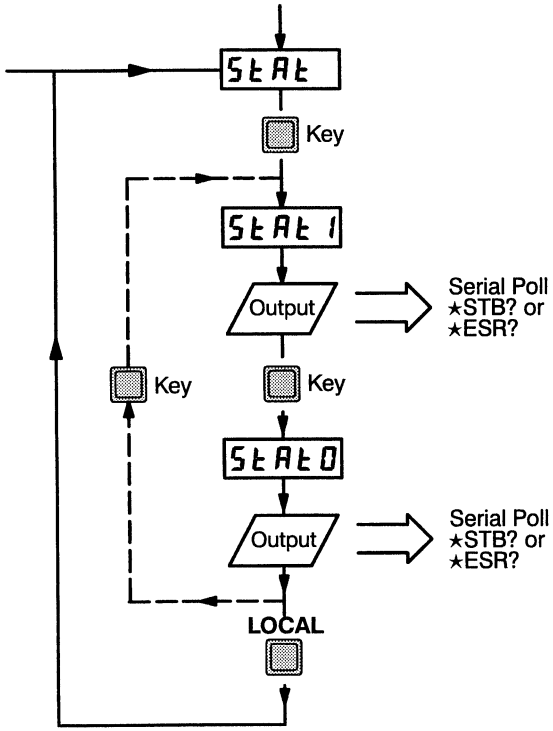
To leave the test program, turn off the instrument.

Device-Status Test:
This test checks the data transfer from the instrument to the Standard Event Status Register and to the Status Byte Register.

Pressing any key (except **LOCAL**) when the display shows ***StAt*** sets the bits of the Standard Event Status Register (ESR) to 1 or 0. The display shows ***StAt 0*** or ***StAt I***.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

If the bits of the Standard Event Status Enable Register (ESE) was set to 1 with the command ⋆ESE 255 the controller can read out the Status Byte Register with serial poll or with the query ⋆STB? (IEEE-488) respectively with ESC 7 for the RS-232 Interface. The result is 0 or 32 decimal, see Programming Manual, Section 3.3.
The Standard Event Status Register also can be read out by a controller with the query ⋆ESR?.

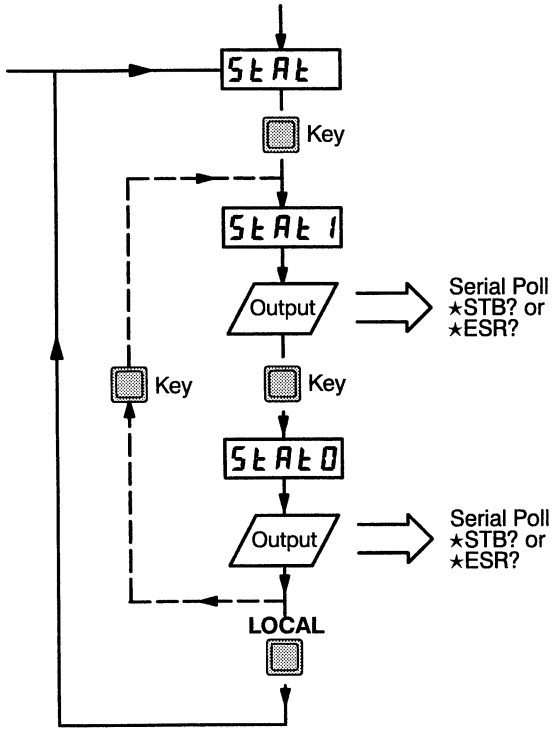


Press the **LOCAL** key to return to the selection between input, output, and status. Press the key again to return to the menu of the test program.

To leave the test program, turn off the instrument.

PM6304 PREVENTIVE MAINTENANCE 5 – 7

If the bits of the Standard Event Status Enable Register (ESE) was set to 1 with the command ⋆ESE 255 the controller can read out the Status Byte Register with serial poll or with the query ⋆STB? (IEEE-488) respectively with ESC 7 for the RS-232 Interface. The result is 0 or 32 decimal, see Programming Manual, Section 3.3.
The Standard Event Status Register also can be read out by a controller with the query ⋆ESR?.



Press the **LOCAL** key to return to the selection between input, output, and status. Press the key again to return to the menu of the test program.

To leave the test program, turn off the instrument.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5.3 RECALIBRATION

The instrument was calibrated in the factory prior to shipment. The calibrating data are stored in an EEPROM and are taken into account during every measurement.
It is necessary to calibrate again after loss of data (replacing the EEPROM), after changing components during repair which might influence the measuring result or when the instrument does not meet the Technical Specifications. In normal operation, recalibration once a year is sufficient. More details on this can be found in the SERVICE MANUAL.

5 – 8 PREVENTIVE MAINTENANCE PM6304

5.3 RECALIBRATION

The instrument was calibrated in the factory prior to shipment. The calibrating data are stored in an EEPROM and are taken into account during every measurement.
It is necessary to calibrate again after loss of data (replacing the EEPROM), after changing components during repair which might influence the measuring result or when the instrument does not meet the Technical Specifications. In normal operation, recalibration once a year is sufficient. More details on this can be found in the SERVICE MANUAL.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

APPENDIX

SERVICE CENTERS

APPENDIX

SERVICE CENTERS

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

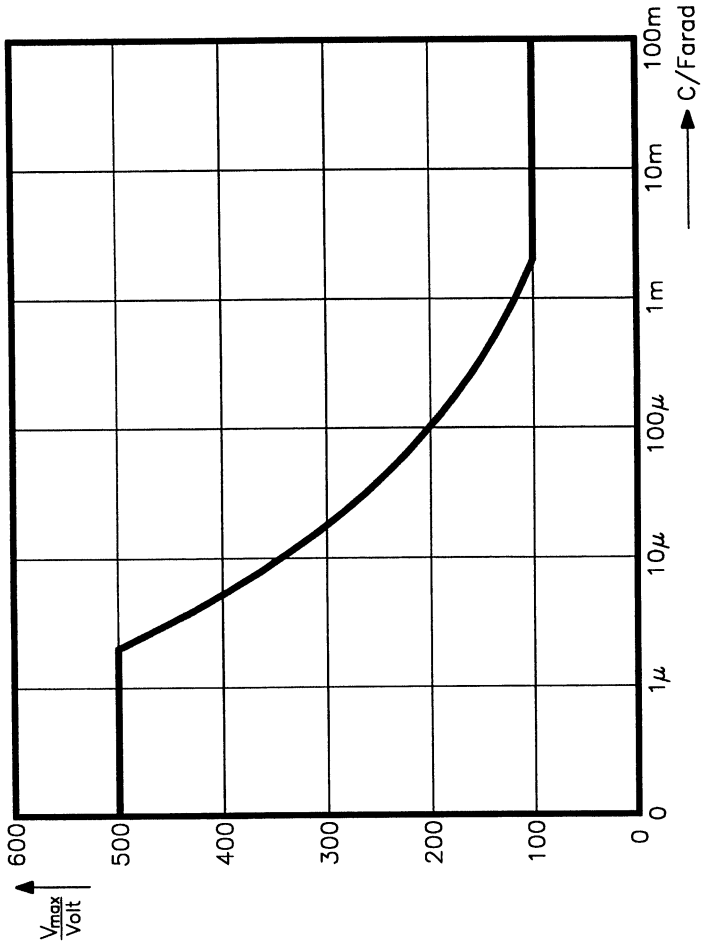


Figure 1 Maximum Charged–Capacitor Voltage

PM6304 APPENDIX – 1 –

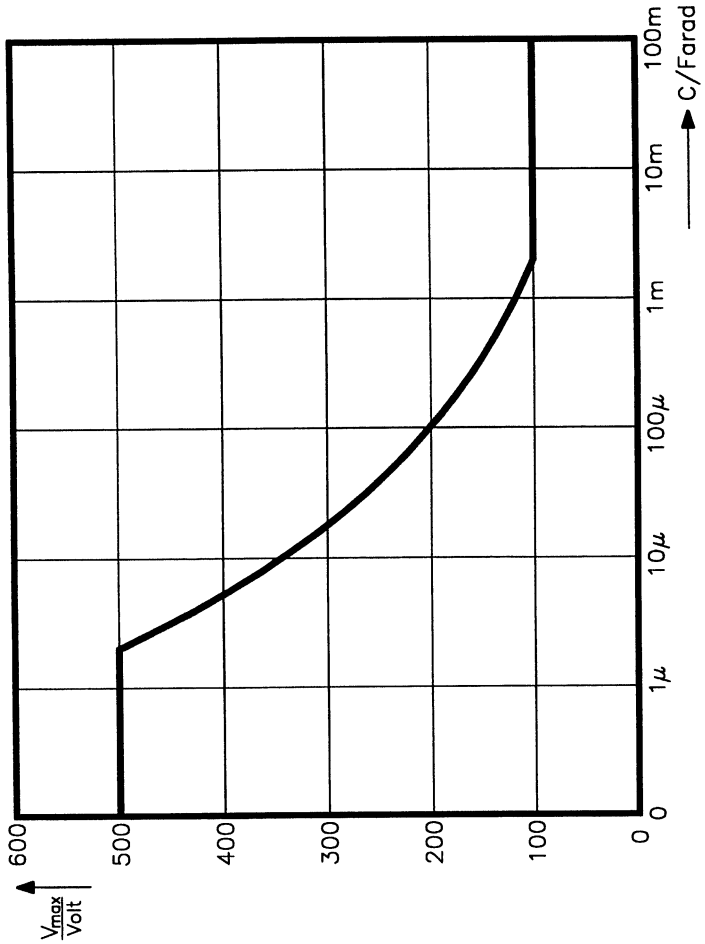


Figure 1 Maximum Charged–Capacitor Voltage

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

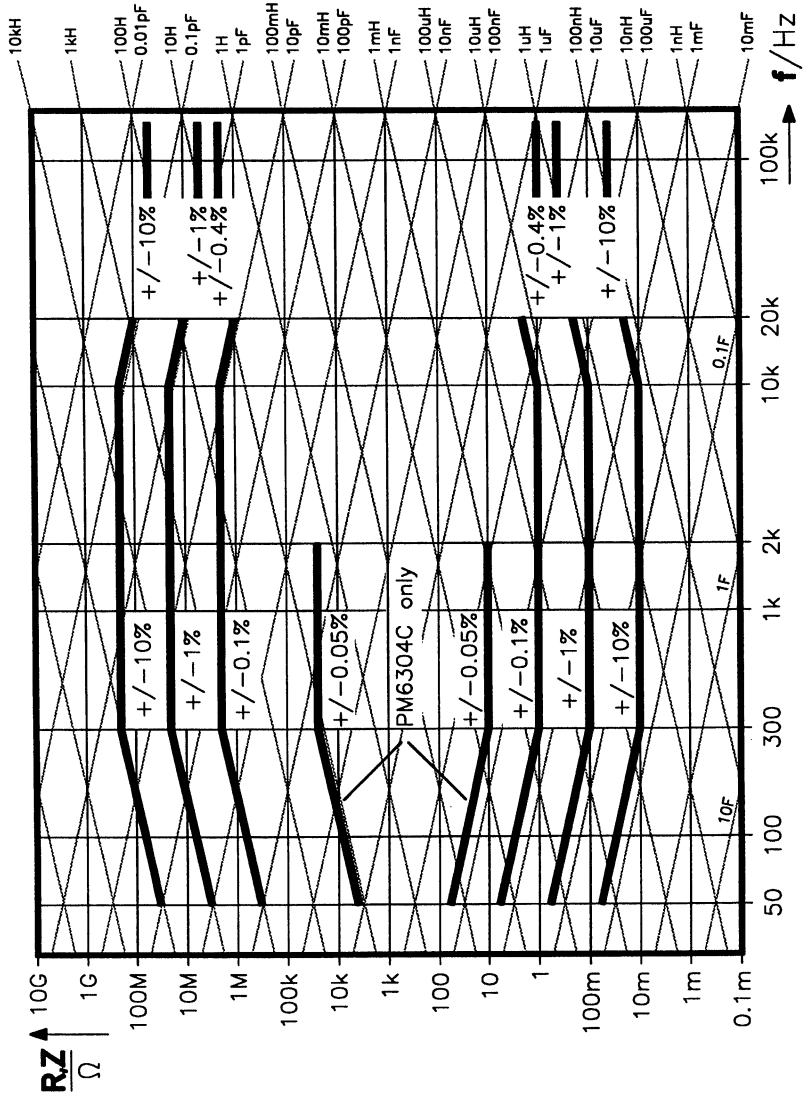


Figure 2 Error Limits for AC, NORMAL LEVEL

– 2 – APPENDIX PM6304

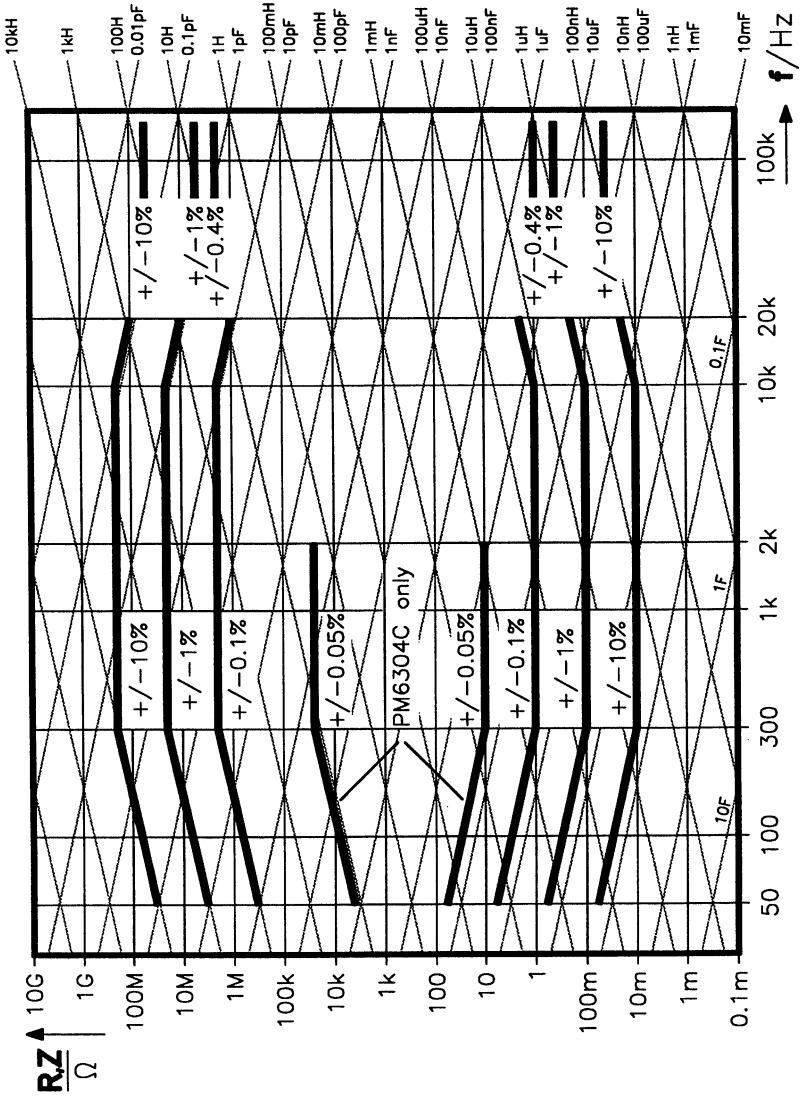


Figure 2 Error Limits for AC, NORMAL LEVEL

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

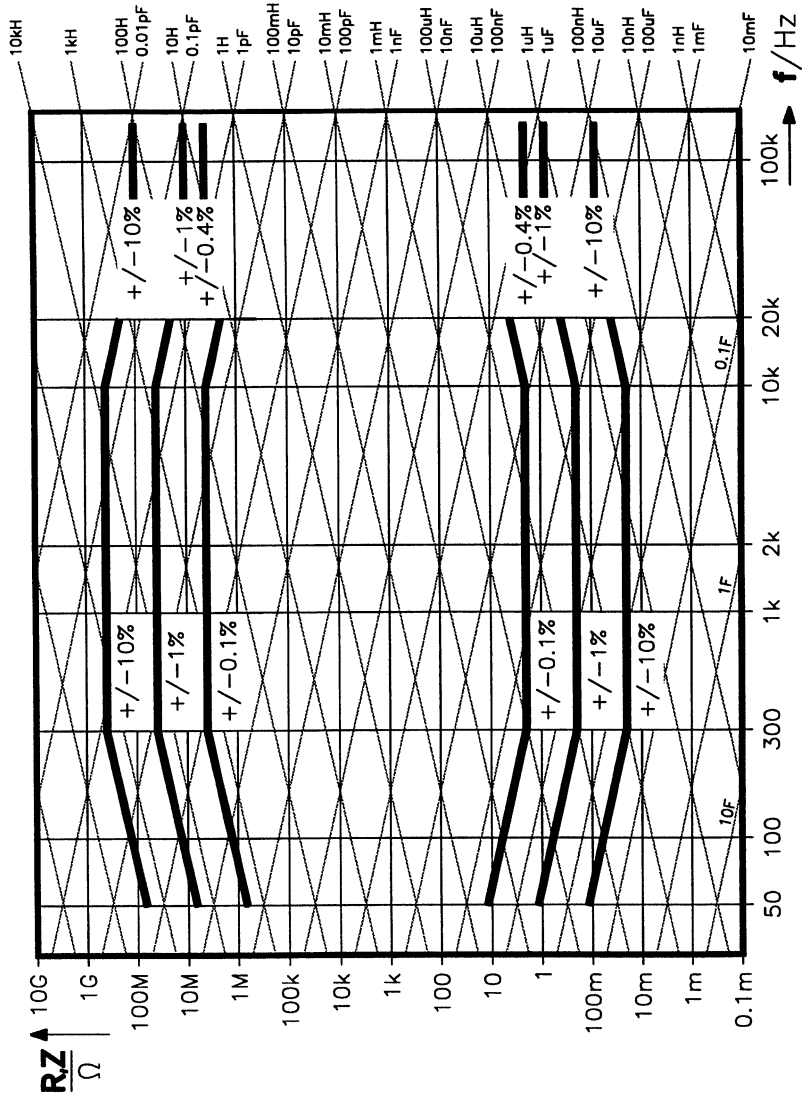


Figure 3 Error Limits for AC, HIGH LEVEL

PM6304 APPENDIX – 3 –

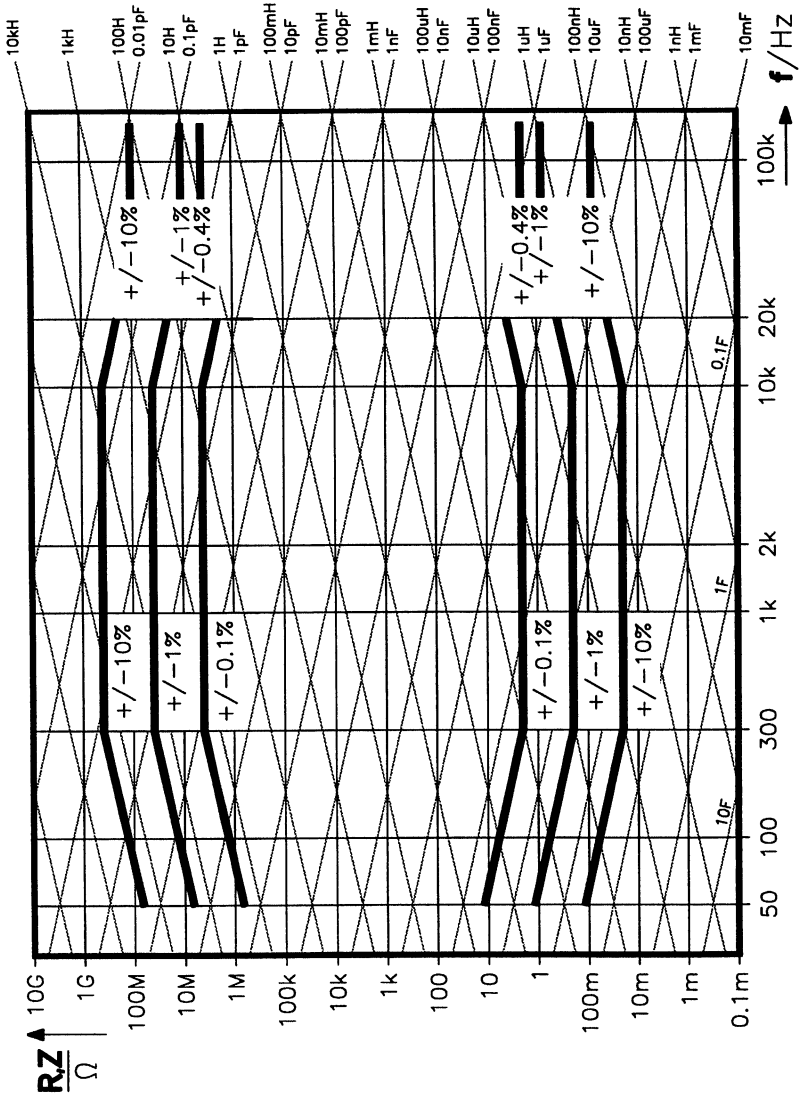


Figure 3 Error Limits for AC, HIGH LEVEL

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

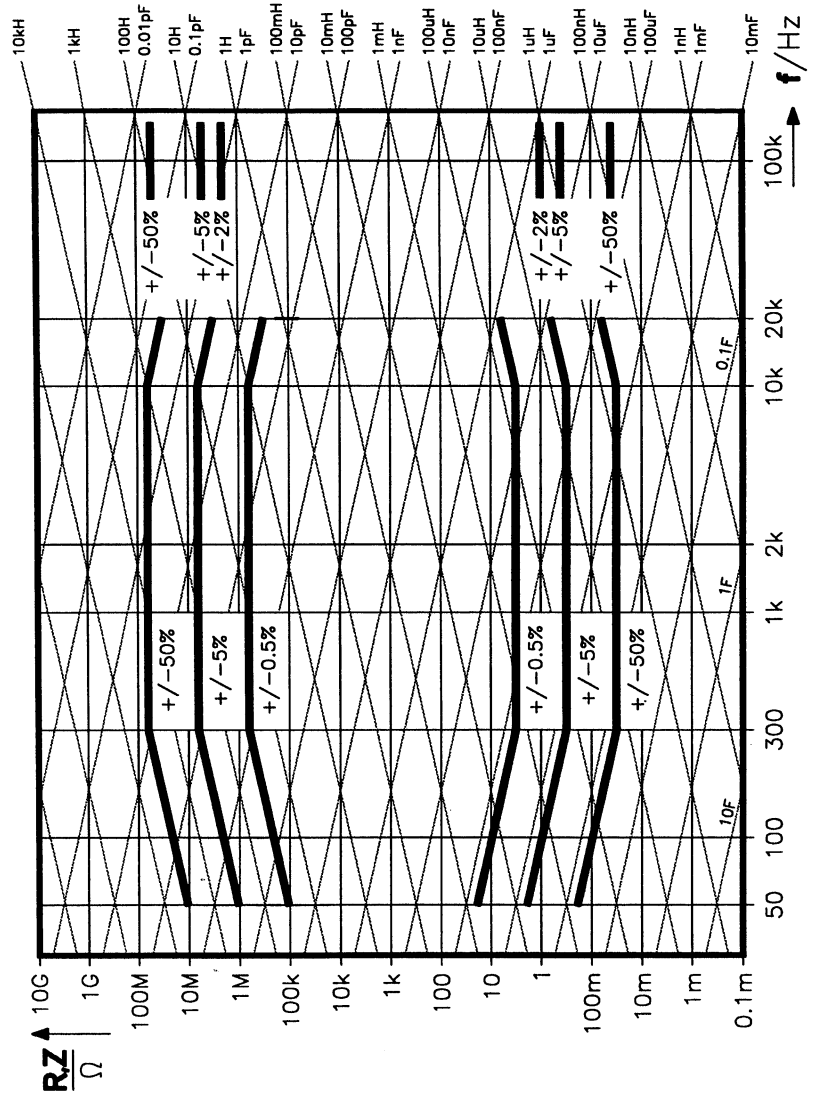


Figure 4 Error Limits for AC, LOW LEVEL

– 4 – APPENDIX PM6304

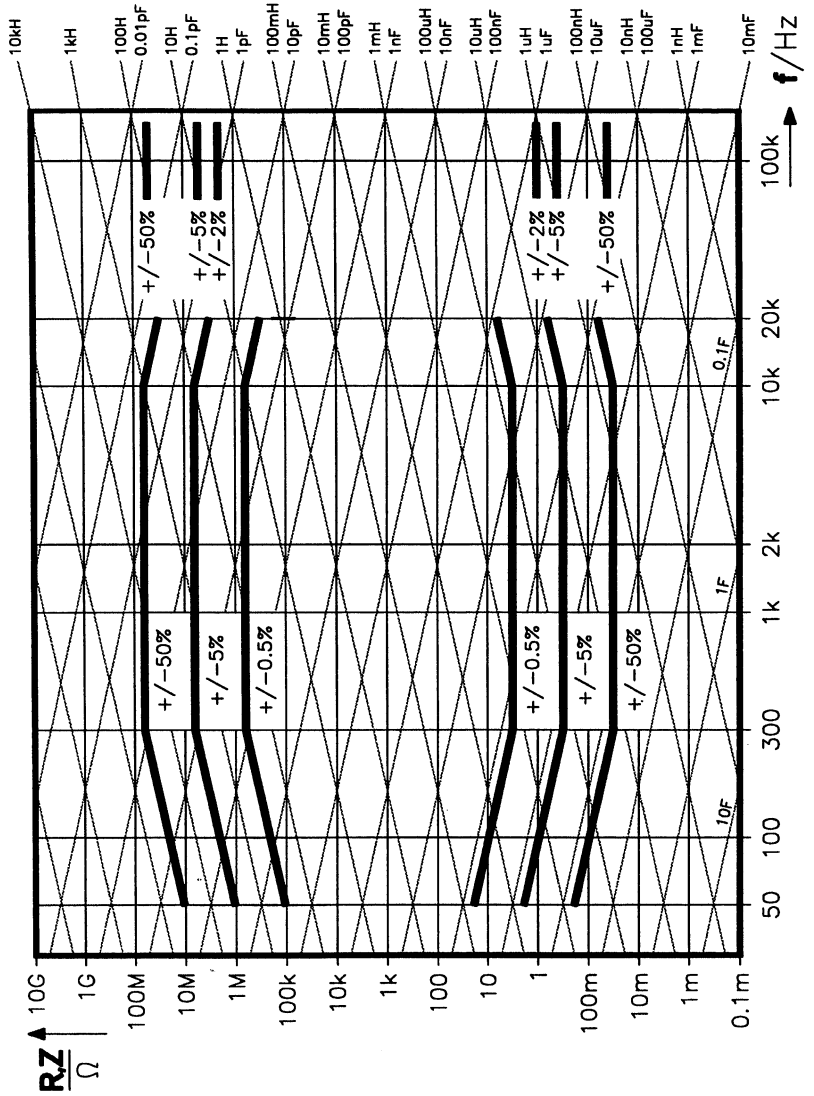


Figure 4 Error Limits for AC, LOW LEVEL

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

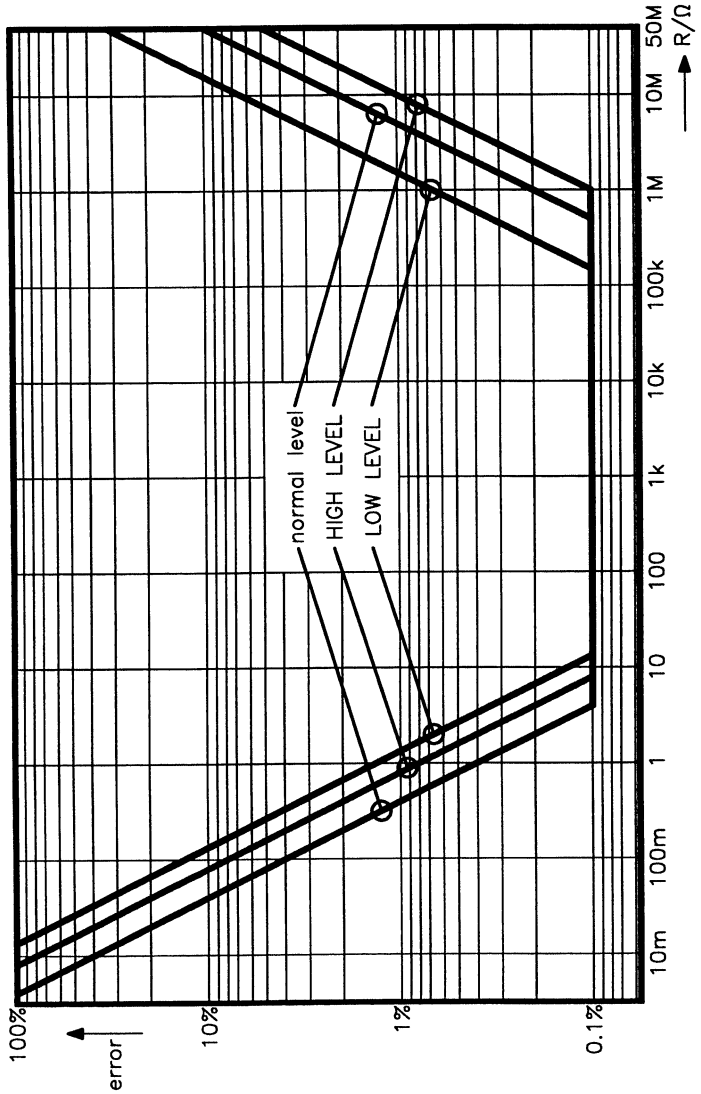


Figure 3 Error Limits for DC, DC Measurements

PM6304 APPENDIX – 5 –

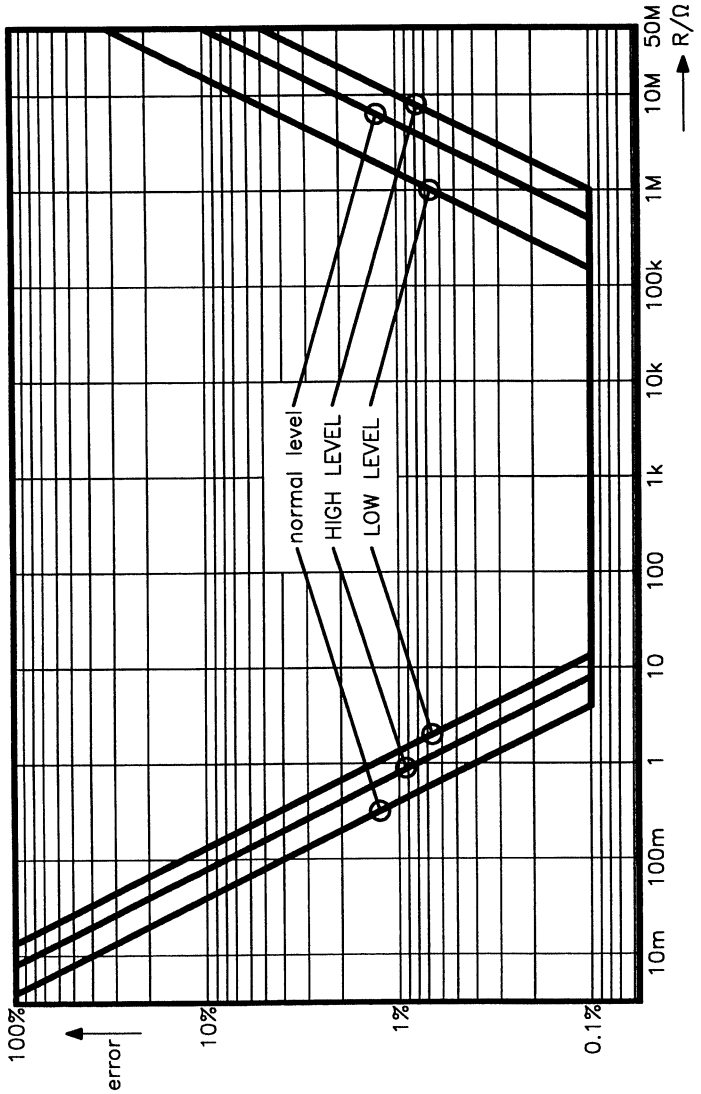


Figure 3 Error Limits for DC, DC Measurements

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERVICE CENTERS

Argentina
Viditec S.A.
Lacarra 234
Buenos Aires CP 1407
Phone: +54-1-636-1200
Fax: +54-1-636-2185

Australia
Philips Scientific & Industrial,
Pty., Ltd.
34 Waterloo Road
North Ryde, N.S.W. 2113
Phone: +61-2-888-8222
Fax: +61-2-888-0440

Austria
Fluke Vertriebsges GmbH
Südrandstraße 7
P.O. Box 10
A 1232 Wien
Phone: +43-1-61410-30
Fax: +43-1-61410-10

Bahrain
Mohammed Fakhroo & Bros.
P.O. Box 439 Bahrain
Phone: +973-253529
Fax: +973-275996

Belgium
N.V. Fluke Belgium S.A.
Sales & Service Department
Langeveldpark - Unit 5 & 7
P. Basteleusstraat 2 - 4 - 6
1600 St. Pieters-Leeuw
Phone: +32-2-331-2777
[Ext 218]
Fax: +32-2-331-1489

Bolivia
Coasin Bolivia S.R.L.
Casilla 7295
Calle Ayacucho No. 208
Edificio Flores, 5to. Piso
La Paz
Phone: +591-2-317531
Fax: +591-2-317545

Brazil
Sistest
Av. Ataulfo De Paiva
135 S/ 1117 - Leblon
22.449-900 - Rio De Janeiro
Phone: +55-21-259-5755
Fax: +55-21-259-5743

Brazil
Sigtron Instrumentos E. Servicos
Ltda
Rua Alvaro Rodriques
269 - Brooklin
Sao Paulo
Phone: +55-11-240-7359
Fax: +55-11-533-3749

Brazil
Philips Medical Syst., Ltda.
Av. Interlagos North
3493 - Campo Grande
04661-200 Sao Paulo S.P.
Phone: +55-11-523-4811
Fax: +55-11-524-4873 (ID2148)

Bulgaria
Ac Sophilco
Customer Support Services
P.O. Box 42
1309 Sofia
Phone: +359-2-292-1815
Fax: +359-2-292-1915

Canada
Fluke Electr. Canada, Inc.
400 Britannia Road East, Unit #1
Mississauga, Ontario
L4Z 1X9
Phone: +1-905-890-7600
Fax: +1-905-890-6866

Chile
Intronica
Instrumentacion Electronica
S.A.C.I
Guardia Vieja 181 Of. 503
Casilla 16500
Santiago 9
Phone: +56-2-232-3888
Fax: 56-2-231-6700

China
Fluke Int'l Corporation
Room 2111 Scite Tower
Jianguomenwai Dajie
Beijing 100004, Prc
Phone: +86-10-512-3436
Fax: +86-10-512-3437

China
China Academy Of Science
Guangzhou Institute Of
Ele. Researc
100 Xian Lie Road Central
Guangzhou
Phone: +86-20-776-9464
Fax: +86-20-776-9464

Colombia
Sistemas E Instrumentacion, Ltda.
Calle 83, No. 37-07 Barrio Patria
Ap. Aereo 29583 Bogota
Phone: +57-1-635-7266
Fax: +57-1-623-3334

Costa Rica
Electronic Engineering, S.A.
Carretera De Circunvalacion
Sabanilla Av. Novena
P.O. Box 4300-1000
San Jose
Phone: +506-*-253-3759
Fax: +506-*-225-1286

Countries not listed
For Eastern Europe And Middle
East
Export Sales
Science Park Eindhoven 5110
5692 EC Son
The Netherlands
Phone: +31-402-678 265
Fax: +31-402-678 260

Croatia
Kaltim - Zagreb
Fluke Sales & Service
Draga 8
41425 Sveta Jana
Phone: +385-41-837115
Fax: +385-41-837237

Cyprus
D. Ouzounian, M. Soultanian & Co.
P.O. Box 1775
Nicosia
Phone: +357-2-442220
Fax: +357-2-459885

Czech Republic
Elso
NA. Berance 2
16000 Prague 6
Phone: +42-2-316-4810
Fax: +42-2-364-986

SERVICE CENTERS

Argentina
Viditec S.A.
Lacarra 234
Buenos Aires CP 1407
Phone: +54-1-636-1200
Fax: +54-1-636-2185

Australia
Philips Scientific & Industrial,
Pty., Ltd.
34 Waterloo Road
North Ryde, N.S.W. 2113
Phone: +61-2-888-8222
Fax: +61-2-888-0440

Austria
Fluke Vertriebsges GmbH
Südrandstraße 7
P.O. Box 10
A 1232 Wien
Phone: +43-1-61410-30
Fax: +43-1-61410-10

Bahrain
Mohammed Fakhroo & Bros.
P.O. Box 439 Bahrain
Phone: +973-253529
Fax: +973-275996

Belgium
N.V. Fluke Belgium S.A.
Sales & Service Department
Langeveldpark - Unit 5 & 7
P. Basteleusstraat 2 - 4 - 6
1600 St. Pieters-Leeuw
Phone: +32-2-331-2777
[Ext 218]
Fax: +32-2-331-1489

Bolivia
Coasin Bolivia S.R.L.
Casilla 7295
Calle Ayacucho No. 208
Edificio Flores, 5to. Piso
La Paz
Phone: +591-2-317531
Fax: +591-2-317545

Brazil
Sistest
Av. Ataulfo De Paiva
135 S/ 1117 - Leblon
22.449-900 - Rio De Janeiro
Phone: +55-21-259-5755
Fax: +55-21-259-5743

Brazil
Sigtron Instrumentos E. Servicos
Ltda
Rua Alvaro Rodriques
269 - Brooklin
Sao Paulo
Phone: +55-11-240-7359
Fax: +55-11-533-3749

Brazil
Philips Medical Syst., Ltda.
Av. Interlagos North
3493 - Campo Grande
04661-200 Sao Paulo S.P.
Phone: +55-11-523-4811
Fax: +55-11-524-4873 (ID2148)

Bulgaria
Ac Sophilco
Customer Support Services
P.O. Box 42
1309 Sofia
Phone: +359-2-292-1815
Fax: +359-2-292-1915

Canada
Fluke Electr. Canada, Inc.
400 Britannia Road East, Unit #1
Mississauga, Ontario
L4Z 1X9
Phone: +1-905-890-7600
Fax: +1-905-890-6866

Chile
Intronica
Instrumentacion Electronica
S.A.C.I
Guardia Vieja 181 Of. 503
Casilla 16500
Santiago 9
Phone: +56-2-232-3888
Fax: 56-2-231-6700

China
Fluke Int'l Corporation
Room 2111 Scite Tower
Jianguomenwai Dajie
Beijing 100004, Prc
Phone: +86-10-512-3436
Fax: +86-10-512-3437

China
China Academy Of Science
Guangzhou Institute Of
Ele. Researc
100 Xian Lie Road Central
Guangzhou
Phone: +86-20-776-9464
Fax: +86-20-776-9464

Colombia
Sistemas E Instrumentacion, Ltda.
Calle 83, No. 37-07 Barrio Patria
Ap. Aereo 29583 Bogota
Phone: +57-1-635-7266
Fax: +57-1-623-3334

Costa Rica
Electronic Engineering, S.A.
Carretera De Circunvalacion
Sabanilla Av. Novena
P.O. Box 4300-1000
San Jose
Phone: +506-*-253-3759
Fax: +506-*-225-1286

Countries not listed
For Eastern Europe And Middle
East
Export Sales
Science Park Eindhoven 5110
5692 EC Son
The Netherlands
Phone: +31-402-678 265
Fax: +31-402-678 260

Croatia
Kaltim - Zagreb
Fluke Sales & Service
Draga 8
41425 Sveta Jana
Phone: +385-41-837115
Fax: +385-41-837237

Cyprus
D. Ouzounian, M. Soultanian & Co.
P.O. Box 1775
Nicosia
Phone: +357-2-442220
Fax: +357-2-459885

Czech Republic
Elso
NA. Berance 2
16000 Prague 6
Phone: +42-2-316-4810
Fax: +42-2-364-986

July-1996 1

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERVICE CENTERS

Czech Republic
Elso
Branch Office
Optatova 17a
63700 Brno
Phone: +42-5-41220263
Fax: +42-5-524742

Denmark
Fluke Danmark A/S
Ejby Industrivej 40
DK 2600 Glostrup
Phone: +45-43-44-1900
Fax: +45-43-43-9192

Ecuador
Proteco Coasin Cia., Ltda.
Av. 12 de Octubre 2449 y
Orellana
P.O. Box 17-03-228-A
Quito
Phone: +593-2-230283
Fax: +593-2-561980

Egypt
EEMCO
Nasr City
19 Shararah Bldgs.
Hassan Mamoun Street
Cairo
Phone: +20-2-2718873
Fax: +20-2-2718873

Finland
Fluke Finland Oy
Sinikalliontie 5
P.L. 151
SF 02631 Espoo
Phone: +358-0-61525-620
Fax: +358-0-61525-630

France
Fluke France S.A.
37, rue Voltaire
B.P. 112
93700 Drancy
Phone: +33-1-4896-6310
Fax: +33-1-4896-6330

Germany
Fluke Deutschland GmbH
Oskar Messter Straße 18
85737 Ismaning
Münich
Phone: +49-89-99611-260
Fax: +49-89-99611-270

Germany
Fluke Deutschland GmbH
Meiendorfer Straße 205
22145 Hamburg
Phone: +49-40-67 960 434
Fax: +49-40-67 960 421

Greece
George D. Zis & SIA O.E.
Fluke Sales & Service
Zacharitsa 27
117 41 Athens
Phone: +30-1-922 1581
Fax: +30-1-924 9087

Hong Kong
Schmidt & Co., Ltd.
1st Floor
323 Jaffe Road
Wanchai
Phone: +852-2223-5623
Fax: +852-2834-1848

Hungary
Mta-Mmsz Kft.
Etele Ut. 59 - 61
P.O. Box 58
H 1502 Budapest
Phone: +361-203-4319
Fax: +361-203-4328

Hungary
MTA-MMSZ Kft.
Etele Ut. 59 - 61
P.O. Box 58
H 1502 Budapest
Phone: +361-203-4298
Fax: +361-203-4353

Iceland
Taeknival Hf
P.O. Box 8294
Skeifunni 17
128 Reykjavik
Phone: +354-550-4000
Fax: +354-550-4001

India
Hinditron Services Pvt., Ltd.
204-206 Hemkunt Tower
98 Nehru Place
New Delhi 110 019
Phone: +91-11-641-3675
Fax: +91-11-642-9118

India
Hinditron Services Pvt., Ltd.
Castle House, 5th Floor
5/1 A, Hungerford Street
Calcutta 700 017
Phone: +91-33-247-9094
Fax: +91-33-247-6844

India
Hinditron Services Pvt., Ltd.
Emerald House, 5th Floor
114 Sarojini Devi Road
Secunderabad 500 003
Phone: +91-40-844033
Fax: +91-40-847585

India
Hinditron Services Pvt., Ltd.
Hinditron House, 23-B
Mahal Industrial Estate
Mahakali Caves Road,
Andheri East
Mumbai 400 093
Phone: +91-22-836-4560
Fax: +91-22-836-4682

India
Hinditron Services Pvt., Inc.
33/44A 8th Main Road
Raj Mahal Vilas Extension
Bangalore 560 080
Phone: +91-80-334-8266
Fax: +91-80-334-5022

Indonesia
P.T. Daeng Brothers
Philips House
J/n H.R. Rasuna Said Kav. 3-4
Jakarta 12950
Phone: +62-21-520-1122
Fax: +62-21-520-5189

Israel
R.D.T Equipment & Systems
(1993) Ltd.
P.O. Box 58072
Tel Aviv 61580
Phone: +972-3-645-0745
Fax: +972-3-647-8908

Italy
Fluke Italia S.R.L.
Viale Delle Industrie, 11
20090 Vimodrone (MI)
Phone: +39-2-268-434-203
Fax: +39-2-250-1645

SERVICE CENTERS

Czech Republic
Elso
Branch Office
Optatova 17a
63700 Brno
Phone: +42-5-41220263
Fax: +42-5-524742

Denmark
Fluke Danmark A/S
Ejby Industrivej 40
DK 2600 Glostrup
Phone: +45-43-44-1900
Fax: +45-43-43-9192

Ecuador
Proteco Coasin Cia., Ltda.
Av. 12 de Octubre 2449 y
Orellana
P.O. Box 17-03-228-A
Quito
Phone: +593-2-230283
Fax: +593-2-561980

Egypt
EEMCO
Nasr City
19 Shararah Bldgs.
Hassan Mamoun Street
Cairo
Phone: +20-2-2718873
Fax: +20-2-2718873

Finland
Fluke Finland Oy
Sinikalliontie 5
P.L. 151
SF 02631 Espoo
Phone: +358-0-61525-620
Fax: +358-0-61525-630

France
Fluke France S.A.
37, rue Voltaire
B.P. 112
93700 Drancy
Phone: +33-1-4896-6310
Fax: +33-1-4896-6330

Germany
Fluke Deutschland GmbH
Oskar Messter Straße 18
85737 Ismaning
Münich
Phone: +49-89-99611-260
Fax: +49-89-99611-270

Germany
Fluke Deutschland GmbH
Meiendorfer Straße 205
22145 Hamburg
Phone: +49-40-67 960 434
Fax: +49-40-67 960 421

Greece
George D. Zis & SIA O.E.
Fluke Sales & Service
Zacharitsa 27
117 41 Athens
Phone: +30-1-922 1581
Fax: +30-1-924 9087

Hong Kong
Schmidt & Co., Ltd.
1st Floor
323 Jaffe Road
Wanchai
Phone: +852-2223-5623
Fax: +852-2834-1848

Hungary
Mta-Mmsz Kft.
Etele Ut. 59 - 61
P.O. Box 58
H 1502 Budapest
Phone: +361-203-4319
Fax: +361-203-4328

Hungary
MTA-MMSZ Kft.
Etele Ut. 59 - 61
P.O. Box 58
H 1502 Budapest
Phone: +361-203-4298
Fax: +361-203-4353

Iceland
Taeknival Hf
P.O. Box 8294
Skeifunni 17
128 Reykjavik
Phone: +354-550-4000
Fax: +354-550-4001

India
Hinditron Services Pvt., Ltd.
204-206 Hemkunt Tower
98 Nehru Place
New Delhi 110 019
Phone: +91-11-641-3675
Fax: +91-11-642-9118

India
Hinditron Services Pvt., Ltd.
Castle House, 5th Floor
5/1 A, Hungerford Street
Calcutta 700 017
Phone: +91-33-247-9094
Fax: +91-33-247-6844

India
Hinditron Services Pvt., Ltd.
Emerald House, 5th Floor
114 Sarojini Devi Road
Secunderabad 500 003
Phone: +91-40-844033
Fax: +91-40-847585

India
Hinditron Services Pvt., Ltd.
Hinditron House, 23-B
Mahal Industrial Estate
Mahakali Caves Road,
Andheri East
Mumbai 400 093
Phone: +91-22-836-4560
Fax: +91-22-836-4682

India
Hinditron Services Pvt., Inc.
33/44A 8th Main Road
Raj Mahal Vilas Extension
Bangalore 560 080
Phone: +91-80-334-8266
Fax: +91-80-334-5022

Indonesia
P.T. Daeng Brothers
Philips House
J/n H.R. Rasuna Said Kav. 3-4
Jakarta 12950
Phone: +62-21-520-1122
Fax: +62-21-520-5189

Israel
R.D.T Equipment & Systems
(1993) Ltd.
P.O. Box 58072
Tel Aviv 61580
Phone: +972-3-645-0745
Fax: +972-3-647-8908

Italy
Fluke Italia S.R.L.
Viale Delle Industrie, 11
20090 Vimodrone (MI)
Phone: +39-2-268-434-203
Fax: +39-2-250-1645

2 July-1996

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERVICE CENTERS

Japan
Fluke Corporation Japan
Sumitomo Higashi Shinbashi Bldg.
1-1-11 Hamamatsucho
Minato-ku, Tokyo 105
Phone: +81-3-3434-0181
Fax: +81-3-3434-0170

Jordan
Jordan Medical Supplies and Services
P.O. Box 140415
Amman 11814
Phone: +962-6-699353
Fax: +962-6-663556

Korea
Fluke Korea Co., Ltd.
5th Floor, Juan Bldg
646-14, Yuksam-Dong
Kangnam-Ku
Seoul 135-080
Phone: +82-2-539-6311
Fax: +82-2-539-6311

Kuwait
Yusuf A. Alghanim & Sons W.L.L.
P.O. Box 223 Safat
Alghanim Industries
Airport Road Shuwaikh
13003 Kuwait
Phone: +965-4842988
Fax: +965-4847244

Lebanon
DC Electronics S.A.R.L.
Autostrada Dora
Hayek Building
P.O. Box 90
1388 Beirut
Phone: +961-1-884271
Fax: +961-1-898842

Macedonia
Tehnokom
Koco Racin 42
91000 Skopje
Phone: +389-91-236817
Fax: +389-91-236851

Malaysia
Cnn Sdn. Bhd.
17D, 2nd Floor
Lebuhraya Batu Lancang
Taman Seri Damai
11600 Jelutong Penang
Phone: +60-4-657-9584
Fax: +60-4-657-0835

Malta
Cam Services Ltd.
Cam Centre
Triq 1 - Industrija
Qormi QRM 09
Phone: +356-484640
Fax: +356-447174

Mexico
Metrologia Y Calibraciones Ind., S.A. De C.V.
Industrial S.A. De C.V.
Calle Diagonal No. 27 - 4 Piso
Colonia Del Valle
Mexico 03100 D.F.
Phone: +52-5-682-8040
Fax: +52-5-687-8695

Netherlands
Fluke Nederland B.V.
Customer Support Services
Science Park Eindhoven 5108
5692 EC Son
Phone: +31-402-678 310
Fax: +31-402-678 321

New Zealand
Philips Scientific & Industrial, Pty., Ltd.
Private Bag 41904
St. Lukes, 2 Wagener Place
Mt. Albert
Auckland 3
Phone: +64-9-849-4160
Fax: +64-9-849-7814

Norway
Fluke Norge A/S
Customer Support Services
P.O. Box 6054
Etterstad
N 0601 Oslo
Phone: +47-22-65-3400
Fax: +47-22-65-3407

Pakistan
Philips Electrical Industries Of Pakistan Ltd.
Islamic Chamber of Commerce
St-2/A, Block 9
KDA Scheme 5, Clifton
Karachi 75600
Phone: +92-21-587-4641
Fax: +92-21-577-0348

Peru
Importaciones & Representaciones
Jr. Pumacahua 955
Lima 11
Phone: +51-14-235099
Fax: +51-14-310707

Philippines
Spark Electronics Corporation
P.O. Box 610, Greenhills
Metro Manila 1502
Phone: +63-2-700621
Fax: +63-2-721-0491

Poland
Electronic Instrument Service (E.I.S.)
UL. Malechowska 6
60 188 Poznan
Phone: +48-61-681998
Fax: +48-61-682256

Portugal
ARESAGANTE
Representacoes Estudos e Servicos, Lda.
Rua Oliveira Gaio, 333 R/C, Esq.
4465 S.Mamede Infesta
Phone: +351-2-906.00.22
Fax: +351-2-901.68.72

Qatar
Darwish Trading Co.
P.O. Box 92
Doha
Phone: +974-422781
Fax: +974-417599

Rep. of Belarus
Component & Systems Ltd.
7, Melnikaite Str.
220004 Minsk
Phone: +375-172-292103
Fax: +375-172-292110

Romania
RONEXPRIM S.R.L.
Str. Transilvaniei Nr. 24
70778 Bucharest - I
Phone: +40-1-6143597
Fax: +40-1-6594468

Russia
Swemel Innovation Enterprise
15, 4-Th Likhachevskiy Lane
125438 Moscow
Phone: +7-095-154-5181
Fax: +7-095-154-0201

SERVICE CENTERS

Japan
Fluke Corporation Japan
Sumitomo Higashi Shinbashi Bldg.
1-1-11 Hamamatsucho
Minato-ku, Tokyo 105
Phone: +81-3-3434-0181
Fax: +81-3-3434-0170

Jordan
Jordan Medical Supplies and Services
P.O. Box 140415
Amman 11814
Phone: +962-6-699353
Fax: +962-6-663556

Korea
Fluke Korea Co., Ltd.
5th Floor, Juan Bldg
646-14, Yuksam-Dong
Kangnam-Ku
Seoul 135-080
Phone: +82-2-539-6311
Fax: +82-2-539-6311

Kuwait
Yusuf A. Alghanim & Sons W.L.L.
P.O. Box 223 Safat
Alghanim Industries
Airport Road Shuwaikh
13003 Kuwait
Phone: +965-4842988
Fax: +965-4847244

Lebanon
DC Electronics S.A.R.L.
Autostrada Dora
Hayek Building
P.O. Box 90
1388 Beirut
Phone: +961-1-884271
Fax: +961-1-898842

Macedonia
Tehnokom
Koco Racin 42
91000 Skopje
Phone: +389-91-236817
Fax: +389-91-236851

Malaysia
Cnn Sdn. Bhd.
17D, 2nd Floor
Lebuhraya Batu Lancang
Taman Seri Damai
11600 Jelutong Penang
Phone: +60-4-657-9584
Fax: +60-4-657-0835

Malta
Cam Services Ltd.
Cam Centre
Triq 1 - Industrija
Qormi QRM 09
Phone: +356-484640
Fax: +356-447174

Mexico
Metrologia Y Calibraciones Ind., S.A. De C.V.
Industrial S.A. De C.V.
Calle Diagonal No. 27 - 4 Piso
Colonia Del Valle
Mexico 03100 D.F.
Phone: +52-5-682-8040
Fax: +52-5-687-8695

Netherlands
Fluke Nederland B.V.
Customer Support Services
Science Park Eindhoven 5108
5692 EC Son
Phone: +31-402-678 310
Fax: +31-402-678 321

New Zealand
Philips Scientific & Industrial, Pty., Ltd.
Private Bag 41904
St. Lukes, 2 Wagener Place
Mt. Albert
Auckland 3
Phone: +64-9-849-4160
Fax: +64-9-849-7814

Norway
Fluke Norge A/S
Customer Support Services
P.O. Box 6054
Etterstad
N 0601 Oslo
Phone: +47-22-65-3400
Fax: +47-22-65-3407

Pakistan
Philips Electrical Industries Of Pakistan Ltd.
Islamic Chamber of Commerce
St-2/A, Block 9
KDA Scheme 5, Clifton
Karachi 75600
Phone: +92-21-587-4641
Fax: +92-21-577-0348

Peru
Importaciones & Representaciones
Jr. Pumacahua 955
Lima 11
Phone: +51-14-235099
Fax: +51-14-310707

Philippines
Spark Electronics Corporation
P.O. Box 610, Greenhills
Metro Manila 1502
Phone: +63-2-700621
Fax: +63-2-721-0491

Poland
Electronic Instrument Service (E.I.S.)
UL. Malechowska 6
60 188 Poznan
Phone: +48-61-681998
Fax: +48-61-682256

Portugal
ARESAGANTE
Representacoes Estudos e Servicos, Lda.
Rua Oliveira Gaio, 333 R/C, Esq.
4465 S.Mamede Infesta
Phone: +351-2-906.00.22
Fax: +351-2-901.68.72

Qatar
Darwish Trading Co.
P.O. Box 92
Doha
Phone: +974-422781
Fax: +974-417599

Rep. of Belarus
Component & Systems Ltd.
7, Melnikaite Str.
220004 Minsk
Phone: +375-172-292103
Fax: +375-172-292110

Romania
RONEXPRIM S.R.L.
Str. Transilvaniei Nr. 24
70778 Bucharest - I
Phone: +40-1-6143597
Fax: +40-1-6594468

Russia
Swemel Innovation Enterprise
15, 4-Th Likhachevskiy Lane
125438 Moscow
Phone: +7-095-154-5181
Fax: +7-095-154-0201

July-1996 3

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERVICE CENTERS

Russia C.I.S.
Infomedia
Petrovsko Razumovsky
Proezd. 29
103287 Moscow
Phone: +7-095-2123833
Fax: +7-095-2123838

Saudi Arabia
A. Rajab & Silsilah Co.
Sales & Service Department
P.O. Box 203
21411 Jeddah
Phone: +966-2-6610006
Fax: +966-2-6610558

Singapore
Fluke Singapore Pte., Ltd.
#27-03 PSA Building
460 Alexandra Road
Singapore 119963
Phone: +65-*-276-5161
Fax: +65-*-276-5929

Slovak Republic
Elso
Stef nikova 20
911 01 Trencin
Phone: +42-8313-1410
Fax: +42-8313-1592

Slovenia
Micom Electronics d.o.o.
Resljeva 34
61000 Ljubljana
Phone: +386-61-317830
Fax: +386-61-320670

Slovenia
Elacss d.o.o.
Medvedova 28
61000 Ljubljana
Phone: +385-61-317178
Fax: +385-61-301595

South Africa
Spescom Measuregraph Pty., Ltd.
SPESCOM Park
Crn. Alexandra Rd. & Second St.
Halfway House
Midrand 1685
Phone: +27-11-315-0757
Fax: +27-11-805-1192

Spain
Fluke Ib,rica S.L.
Centro Empresarial Euronova
C/Ronda De Poniente, 8
28760 - Tres Cantos
Madrid
Phone: +34-1-804-2301
Fax: +34-1-804-2496

Sultanate Of Oman
Mustafa & Jawad Science &
Industry Co. LLC.
P.O. Box 1918
112 Ruwi - Muscat
Phone: +968-602009
Fax: +968-607066

Sweden
Fluke Sverige AB
P.O. Box 61
S 164 94 Kista
Phone: +46-8-751-0235
Fax: +46-8-751-0480

Switzerland
Fluke Switzerland A.G.
Rütistrasse 28
CH 8952 Schlieren
Phone: +41-1-730-3310
Fax: +41-1-730-3720

Taiwan, R.O.C.
Schmidt Scientific Taiwan, Ltd.
6f, No. 109, Tung Hsing St.
Taipei
Phone: +886-2-767-8890
Fax: +886-2-767-8820

Thailand
Measuretronix Ltd.
2102/31 Ramkamhang Road
Bangkok 10240
Phone: +66-2-375-2733
Fax: +66-2-374-9965

Turkey
Pestas Prof. Elektr. Sistemler
Tic. ve San. A.S.
Meydan Sokak
Meydan Apt. No. 6/23
Akatlar 80630
Istanbul
Phone: +90-212-2827839
Fax: +90-212-283-0987

U.A.E.
Haris Al-Afaq Ltd.
P.O. Box 8141
Dubai
Phone: +971-4-283623
Fax: +971-4-281285

U.S.A.
Fluke Corporation
Service Center - Palatine
1150 W. Euclid Avenue
Palatine, IL 60067
Phone: +1-847-705-0500
Fax: +1-847-705-9989

U.S.A.
Fluke Corporation
Service Center - Paramus
West 75 Century Road
Paramus, NJ 07652-0930

U.S.A.
Fluke Corporation
Service Center - Everett
P.O. Box 9090
Everett, WA 98206-9090
Phone: +1-206-356-5531
Fax: +1 206 356 6390

U.S.A.
Fluke Calibration Center
C/o Flw Service Corporation
3505 Cadillac Ave., Bldg E.
Costa Mesa, Ca 92626
Phone: +1-714-863-9031
Fax: +1-714-751-0213

U.S.A.
Fluke Corporation
Service Center
42711 Lawrence Place
Fremont, CA 94538
Phone: +1-510-651-5112
Fax: +1-510-651-4962

U.S.A.
Fluke Corporation
Service Center - Dallas
2104 Hutton Drive
Suite 112
Carrollton, TX 75006
Phone: +1-214-406-1000
Fax: +1-214-247-5642

SERVICE CENTERS

Russia C.I.S.
Infomedia
Petrovsko Razumovsky
Proezd. 29
103287 Moscow
Phone: +7-095-2123833
Fax: +7-095-2123838

Saudi Arabia
A. Rajab & Silsilah Co.
Sales & Service Department
P.O. Box 203
21411 Jeddah
Phone: +966-2-6610006
Fax: +966-2-6610558

Singapore
Fluke Singapore Pte., Ltd.
#27-03 PSA Building
460 Alexandra Road
Singapore 119963
Phone: +65-*-276-5161
Fax: +65-*-276-5929

Slovak Republic
Elso
Stef nikova 20
911 01 Trencin
Phone: +42-8313-1410
Fax: +42-8313-1592

Slovenia
Micom Electronics d.o.o.
Resljeva 34
61000 Ljubljana
Phone: +386-61-317830
Fax: +386-61-320670

Slovenia
Elacss d.o.o.
Medvedova 28
61000 Ljubljana
Phone: +385-61-317178
Fax: +385-61-301595

South Africa
Spescom Measuregraph Pty., Ltd.
SPESCOM Park
Crn. Alexandra Rd. & Second St.
Halfway House
Midrand 1685
Phone: +27-11-315-0757
Fax: +27-11-805-1192

Spain
Fluke Ib,rica S.L.
Centro Empresarial Euronova
C/Ronda De Poniente, 8
28760 - Tres Cantos
Madrid
Phone: +34-1-804-2301
Fax: +34-1-804-2496

Sultanate Of Oman
Mustafa & Jawad Science &
Industry Co. LLC.
P.O. Box 1918
112 Ruwi - Muscat
Phone: +968-602009
Fax: +968-607066

Sweden
Fluke Sverige AB
P.O. Box 61
S 164 94 Kista
Phone: +46-8-751-0235
Fax: +46-8-751-0480

Switzerland
Fluke Switzerland A.G.
Rütistrasse 28
CH 8952 Schlieren
Phone: +41-1-730-3310
Fax: +41-1-730-3720

Taiwan, R.O.C.
Schmidt Scientific Taiwan, Ltd.
6f, No. 109, Tung Hsing St.
Taipei
Phone: +886-2-767-8890
Fax: +886-2-767-8820

Thailand
Measuretronix Ltd.
2102/31 Ramkamhang Road
Bangkok 10240
Phone: +66-2-375-2733
Fax: +66-2-374-9965

Turkey
Pestas Prof. Elektr. Sistemler
Tic. ve San. A.S.
Meydan Sokak
Meydan Apt. No. 6/23
Akatlar 80630
Istanbul
Phone: +90-212-2827839
Fax: +90-212-283-0987

U.A.E.
Haris Al-Afaq Ltd.
P.O. Box 8141
Dubai
Phone: +971-4-283623
Fax: +971-4-281285

U.S.A.
Fluke Corporation
Service Center - Palatine
1150 W. Euclid Avenue
Palatine, IL 60067
Phone: +1-847-705-0500
Fax: +1-847-705-9989

U.S.A.
Fluke Corporation
Service Center - Paramus
West 75 Century Road
Paramus, NJ 07652-0930

U.S.A.
Fluke Corporation
Service Center - Everett
P.O. Box 9090
Everett, WA 98206-9090
Phone: +1-206-356-5531
Fax: +1 206 356 6390

U.S.A.
Fluke Calibration Center
C/o Flw Service Corporation
3505 Cadillac Ave., Bldg E.
Costa Mesa, Ca 92626
Phone: +1-714-863-9031
Fax: +1-714-751-0213

U.S.A.
Fluke Corporation
Service Center
42711 Lawrence Place
Fremont, CA 94538
Phone: +1-510-651-5112
Fax: +1-510-651-4962

U.S.A.
Fluke Corporation
Service Center - Dallas
2104 Hutton Drive
Suite 112
Carrollton, TX 75006
Phone: +1-214-406-1000
Fax: +1-214-247-5642

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

United Kingdom
Fluke United Kingdom Ltd.
Colonial Way
Watford
Hertfordshire WD2 4TT
Phone: +44-1923-240511
Fax: +44-1923-212157

Uruguay
Coasin Instrumentos S.A.
Acevedo Diaz 1161
11200 Montevideo
Montevideo
Phone: +598-2-492-436
Fax: +598-2-492-199

Venezuela
Coasin C.A.
Calle 9 Con Calle 4
Edif Edinurbi Piso - 3
La Urbina
Caracas 1070-A
Phone: +58-2-242-7466
Fax: +58-2-241-1939

Vietnam
Schmidt-Vietnam Co., Ltd.
8/f. Schmidt Tower
Hanoi International Technology
Ctr
Km8, Highway 32, Cau Giay
Tu Liem, Hanoi
Phone: +84-4-8346-186
Fax: +84-4-8346-188

All other countries
Fluke Corporation
P.O. Box 9090
Mail Stop 268C
Everett, WA 98206-9090
USA

SERVICE CENTERS

United Kingdom
Fluke United Kingdom Ltd.
Colonial Way
Watford
Hertfordshire WD2 4TT
Phone: +44-1923-240511
Fax: +44-1923-212157

Uruguay
Coasin Instrumentos S.A.
Acevedo Diaz 1161
11200 Montevideo
Montevideo
Phone: +598-2-492-436
Fax: +598-2-492-199

Venezuela
Coasin C.A.
Calle 9 Con Calle 4
Edif Edinurbi Piso - 3
La Urbina
Caracas 1070-A
Phone: +58-2-242-7466
Fax: +58-2-241-1939

Vietnam
Schmidt-Vietnam Co., Ltd.
8/f. Schmidt Tower
Hanoi International Technology
Ctr
Km8, Highway 32, Cau Giay
Tu Liem, Hanoi
Phone: +84-4-8346-186
Fax: +84-4-8346-188

All other countries
Fluke Corporation
P.O. Box 9090
Mail Stop 268C
Everett, WA 98206-9090
USA

July-1996 5

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERVICE CENTERS

To locate an authorized service center, visit us on the World Wide Web:

http://www.fluke.com

or call Fluke using any of the phone numbers listed below:

+1-888-993-5853 in U.S.A. and Canada

+31-402-678-200 in Europe

+1-425-356-5500 from other countries

SERVICE CENTERS

To locate an authorized service center, visit us on the World Wide Web:

http://www.fluke.com

or call Fluke using any of the phone numbers listed below:

+1-888-993-5853 in U.S.A. and Canada

+31-402-678-200 in Europe

+1-425-356-5500 from other countries

SERVICE-ZENTREN

Wenn Sie die Adresse eines authorizierten Fluke-Servicezentrums brauchen,

besuchen Sie uns doch bitte auf dem World Wide Web:

http://www.fluke.com

oder rufen Sie uns unter einer der nachstehenden Telefonnummern an:

+1-888-993-5853 in den USA und Canada

+31-402-678-200 in Europa

+1-425-356-5500 von anderen Ländern aus

SERVICE-ZENTREN

Wenn Sie die Adresse eines authorizierten Fluke-Servicezentrums brauchen,

besuchen Sie uns doch bitte auf dem World Wide Web:

http://www.fluke.com

oder rufen Sie uns unter einer der nachstehenden Telefonnummern an:

+1-888-993-5853 in den USA und Canada

+31-402-678-200 in Europa

+1-425-356-5500 von anderen Ländern aus

CENTRES DE SERVICE APRES-VENTE

Pour localiser un centre de service, visitez-nous sur le World Wide Web:

http://www.fluke.com

ou téléphonez à Fluke:

+1-888-993-5853 aux U.S.A. et au Canada

+31-402-678-200 en Europe

+1-425-356-5500 pour les autres pays

CENTRES DE SERVICE APRES-VENTE

Pour localiser un centre de service, visitez-nous sur le World Wide Web:

http://www.fluke.com

ou téléphonez à Fluke:

+1-888-993-5853 aux U.S.A. et au Canada

+31-402-678-200 en Europe

+1-425-356-5500 pour les autres pays

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP