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

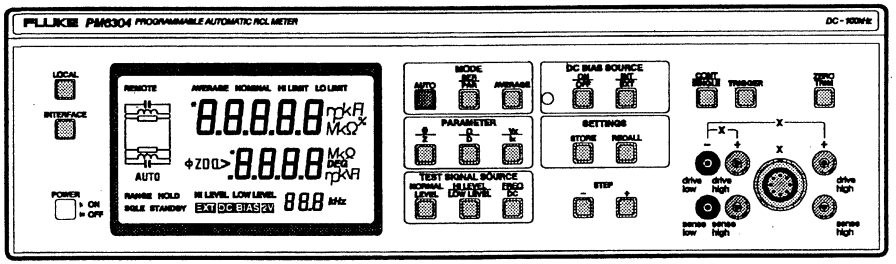
All trademarks, brand names, and brands appearing herein are the property of their respective owners.

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

Programmable Automatic RCL Meter

PM6304

Programmers Manual 951111

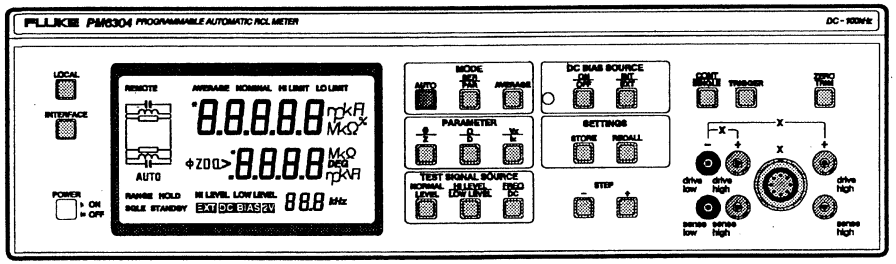


FLUKE®

Programmable Automatic RCL Meter

PM6304

Programmers Manual 951111



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.

The wordmark Philips and the Philips shieldemblem
are used under licence from Philips Export B.V.
© 1995, 1996 Fluke Corporation.
All rights reserved.
Data subject to change without notice
Printed in Germany

FLUKE®

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.

The wordmark Philips and the Philips shieldemblem
are used under licence from Philips Export B.V.
© 1995, 1996 Fluke Corporation.
All rights reserved.
Data subject to change without notice
Printed in Germany

FLUKE®

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

INSIDE THIS MANUAL

This PROGRAMMERS MANUAL contains information about how to control the PM6304 / PM6304C by a Personal Computer or Controller via IEEE-488 or RS-232.

The manual is organized into the following chapters:

Chapter 1 IEEE-488 Interface

This chapter describes the function of the IEEE-488 interface and how to set the instrument address.

Chapter 2 RS-232 Interface

This chapter describes the RS-232 interface and the steps necessary for configuration.

Chapter 3 Remote Control Commands

This chapter contains information about the Message Syntax and describes all commands necessary for operation via IEEE-488 as well as via RS-232.

Chapter 4 Programming Examples

This chapter shows programming examples for IEEE-488 and RS-232.

Chapter 5 Printing of Measurement Results

This chapter shows a setup for direct printing of measurement results without PC.

Chapter 6 Error Messages

This chapter lists error messages with references to chapters in this manual and to the Service Manual where the topic is described.

Chapter 7 Commands in Alphabetical Order

This chapter shows all commands and queries in a short form. It serves as a reference for correct syntax.

PM6304 INSIDE THIS MANUAL – 1 –

INSIDE THIS MANUAL

This PROGRAMMERS MANUAL contains information about how to control the PM6304 / PM6304C by a Personal Computer or Controller via IEEE-488 or RS-232.

The manual is organized into the following chapters:

Chapter 1 IEEE-488 Interface

This chapter describes the function of the IEEE-488 interface and how to set the instrument address.

Chapter 2 RS-232 Interface

This chapter describes the RS-232 interface and the steps necessary for configuration.

Chapter 3 Remote Control Commands

This chapter contains information about the Message Syntax and describes all commands necessary for operation via IEEE-488 as well as via RS-232.

Chapter 4 Programming Examples

This chapter shows programming examples for IEEE-488 and RS-232.

Chapter 5 Printing of Measurement Results

This chapter shows a setup for direct printing of measurement results without PC.

Chapter 6 Error Messages

This chapter lists error messages with references to chapters in this manual and to the Service Manual where the topic is described.

Chapter 7 Commands in Alphabetical Order

This chapter shows all commands and queries in a short form. It serves as a reference for correct syntax.

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

Using the Programmers Manual requires that you are acquainted with the functions of the instrument, measurement setups, parameters and limits.

For detailed information about:
- Characteristics

see **REFERENCE MANUAL**

For detailed information about:
- Safety Precautions
- Getting Started
- How to Use the Instrument
- Function Reference

see **USERS MANUAL** (English)
GEBRAUCHSANLEITUNG (German)
MODE D'EMPLOI (French)

– 2 – INSIDE THIS MANUAL PM6304

Using the Programmers Manual requires that you are acquainted with the functions of the instrument, measurement setups, parameters and limits.

For detailed information about:
- Characteristics

see **REFERENCE MANUAL**

For detailed information about:
- Safety Precautions
- Getting Started
- How to Use the Instrument
- Function Reference

see **USERS MANUAL** (English)
GEBRAUCHSANLEITUNG (German)
MODE D'EMPLOI (French)

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

CONTENTS

		Page
1	**IEEE-488 INTERFACE**	**1 – 1**
1.1	INSTRUMENT ADDRESS	1 – 1
1.2	INTERFACE FUNCTIONS	1 – 2
2	**RS-232 INTERFACE**	**2 – 1**
2.1	INSTRUMENT CONFIGURATION	2 – 1
2.2	INTERFACE FUNCTIONS AND WIRING	2 – 5
2.3	SPECIAL INTERFACE FUNCTIONS	2 – 7
3	**REMOTE CONTROL COMMANDS**	**3 – 1**
3.1	PROGRAM MESSAGE SYNTAX	3 – 1
3.2	MESSAGE TERMINATOR	3 – 1
3.3	SERVICE REQUEST (SRQ) AND STATUS REGISTERS	3 – 2
3.4	COMMON COMMANDS (IEEE-488.2)	3 – 4
3.5	DEVICE SPECIFIC MESSAGES	3 – 8
	3.5.1 Instrument Settings and Measurements	3 – 9
	3.5.2 Binning	3 – 18
	3.5.3 Additional Commands	3 – 25
4	**PROGRAMMING EXAMPLES**	**4 – 1**
4.1	IEEE-488 INTERFACE	4 – 1
4.2	RS-232 INTERFACE	4 – 4
5	**PRINTING OF MEASURMENT RESULTS**	**5 – 1**
6	**ERROR MESSAGES**	**6 – 1**
7	**COMMANDS IN ALPHABETICAL ORDER**	**7 – 1**
7.1	COMMON COMMANDS AND QUERIES (IEEE-488.2)	7 – 1
7.2	DEVICE SPECIFIC COMMANDS	7 – 2
	7.2.1 Settings and Measurements	7 – 2
	7.2.2 Commands for Binning	7 – 4

PM6304 CONTENTS

CONTENTS

		Page
1	**IEEE-488 INTERFACE**	**1 – 1**
1.1	INSTRUMENT ADDRESS	1 – 1
1.2	INTERFACE FUNCTIONS	1 – 2
2	**RS-232 INTERFACE**	**2 – 1**
2.1	INSTRUMENT CONFIGURATION	2 – 1
2.2	INTERFACE FUNCTIONS AND WIRING	2 – 5
2.3	SPECIAL INTERFACE FUNCTIONS	2 – 7
3	**REMOTE CONTROL COMMANDS**	**3 – 1**
3.1	PROGRAM MESSAGE SYNTAX	3 – 1
3.2	MESSAGE TERMINATOR	3 – 1
3.3	SERVICE REQUEST (SRQ) AND STATUS REGISTERS	3 – 2
3.4	COMMON COMMANDS (IEEE-488.2)	3 – 4
3.5	DEVICE SPECIFIC MESSAGES	3 – 8
	3.5.1 Instrument Settings and Measurements	3 – 9
	3.5.2 Binning	3 – 18
	3.5.3 Additional Commands	3 – 25
4	**PROGRAMMING EXAMPLES**	**4 – 1**
4.1	IEEE-488 INTERFACE	4 – 1
4.2	RS-232 INTERFACE	4 – 4
5	**PRINTING OF MEASURMENT RESULTS**	**5 – 1**
6	**ERROR MESSAGES**	**6 – 1**
7	**COMMANDS IN ALPHABETICAL ORDER**	**7 – 1**
7.1	COMMON COMMANDS AND QUERIES (IEEE-488.2)	7 – 1
7.2	DEVICE SPECIFIC COMMANDS	7 – 2
	7.2.1 Settings and Measurements	7 – 2
	7.2.2 Commands for Binning	7 – 4

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 1

IEEE-488 INTERFACE

Chapter 1

IEEE-488 INTERFACE

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 IEEE-488 INTERFACE

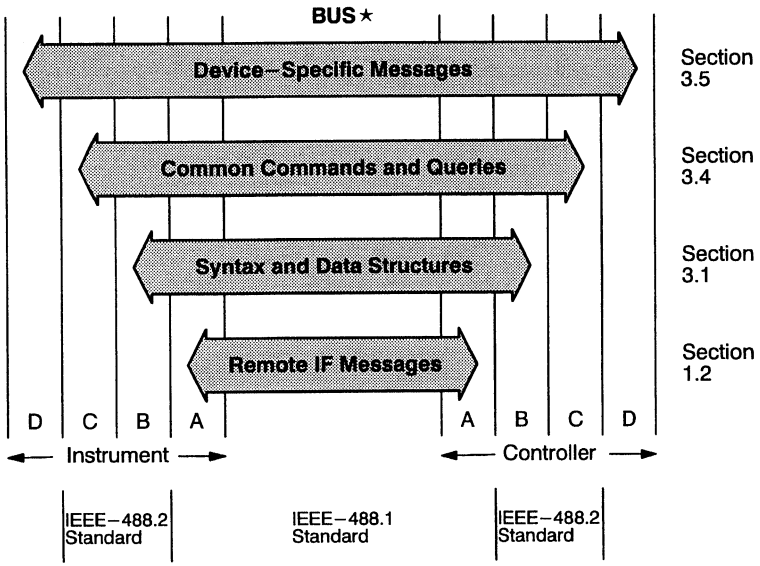
1.1 INSTRUMENT ADDRESS

All instrument functions can be controlled via the IEEE-488/IEC interface.

Before learning the remote interface command set, first get acquainted with the functions of the instrument, measurement setups, parameters, and limits. A detailed description with examples is in the USERS MANUAL or GEBRAUCHSANLEITUNG or MODE D'EMPLOI.

The following chapter describes the functions of the IEEE-488 bus interface.

For commands, queries, syntax, and terminators, see Chapter 3.



A = Interface functions
B = Message communication functions
C = Common system functions
D = Device functions

★ This figure is in accordance with "IEEE-488 Standard Codes, Formats, Protocols, and Common Commands" (ANSI/IEEE-488 Std 488.2-1987).

PM6304 IEEE–488 INTERFACE 1 – 1

1 IEEE-488 INTERFACE

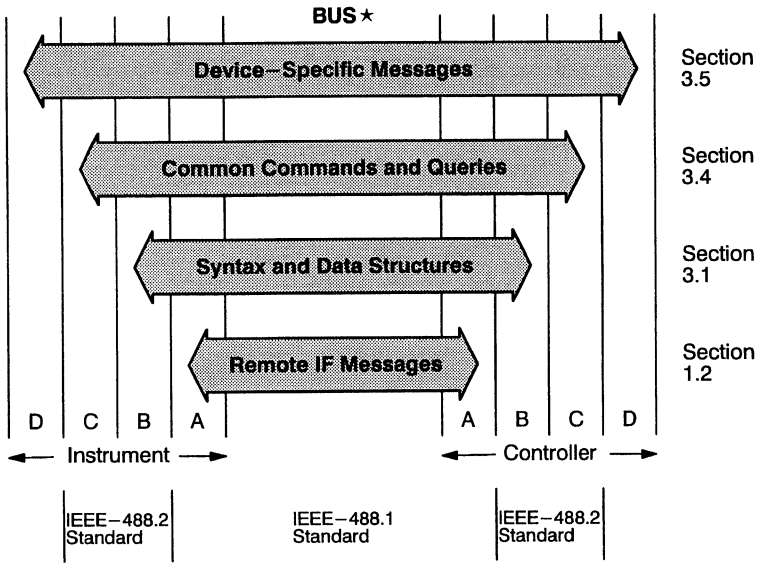
1.1 INSTRUMENT ADDRESS

All instrument functions can be controlled via the IEEE-488/IEC interface.

Before learning the remote interface command set, first get acquainted with the functions of the instrument, measurement setups, parameters, and limits. A detailed description with examples is in the USERS MANUAL or GEBRAUCHSANLEITUNG or MODE D'EMPLOI.

The following chapter describes the functions of the IEEE-488 bus interface.

For commands, queries, syntax, and terminators, see Chapter 3.



A = Interface functions
B = Message communication functions
C = Common system functions
D = Device functions

★ This figure is in accordance with "IEEE-488 Standard Codes, Formats, Protocols, and Common Commands" (ANSI/IEEE-488 Std 488.2-1987).

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

Remote control of the instrument requires the instrument address to be known. On delivery from the factory the address is set to 20. You can display the set address by pressing the INTERFACE key. You can change the address from 1 to 30 by pressing the step keys.

On power up the instrument is in 'local' mode (input via keyboard). When addressed as listener by a controller, the text REMOTE appears in the display field. All keys except LOCAL are locked and you can now operate the instrument in remote control. To return to local operation, use the addressed command GTL (go to local) or press the LOCAL key. To avoid unintended local control, you can disable the LOCAL key by using the universal command LLO (local lockout).

1.2 INTERFACE FUNCTIONS

The following interface functions are implemented:

AH1:	acceptor handshake	SR1:	service request SRQ
SH1:	source handshake	DC1:	device clear function
L4:	listener function	DT1:	device trigger function
T6:	talker function	PP0:	no parallel poll
RL1:	local/remote with local lockout	C0:	no controller function
		E2:	tri-state drivers

Hardware, connections, and the handshake procedure are in accordance with IEEE-488.1.

1 – 2 IEEE–488 INTERFACE PM6304

Remote control of the instrument requires the instrument address to be known. On delivery from the factory the address is set to 20. You can display the set address by pressing the INTERFACE key. You can change the address from 1 to 30 by pressing the step keys.

On power up the instrument is in 'local' mode (input via keyboard). When addressed as listener by a controller, the text REMOTE appears in the display field. All keys except LOCAL are locked and you can now operate the instrument in remote control. To return to local operation, use the addressed command GTL (go to local) or press the LOCAL key. To avoid unintended local control, you can disable the LOCAL key by using the universal command LLO (local lockout).

1.2 INTERFACE FUNCTIONS

The following interface functions are implemented:

AH1:	acceptor handshake	SR1:	service request SRQ
SH1:	source handshake	DC1:	device clear function
L4:	listener function	DT1:	device trigger function
T6:	talker function	PP0:	no parallel poll
RL1:	local/remote with local lockout	C0:	no controller function
		E2:	tri-state drivers

Hardware, connections, and the handshake procedure are in accordance with IEEE-488.1.

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

Chapter 2

RS-232 INTERFACE

Chapter 2

RS-232 INTERFACE

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 RS-232 INTERFACE

2.1 INSTRUMENT CONFIGURATION

All instrument functions can be controlled via the RS-232 interface.

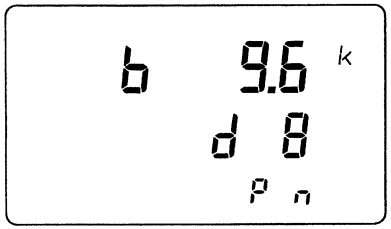
Before learning the remote interface command set, first get acquainted with the functions of the instrument, measurement setups, parameters, and limits. A detailed description with examples is in the USERS MANUAL (also in the GEBRAUCHSANLEITUNG or MODE D'EMPLOI).

The following chapter describes the functions of the RS-232 bus interface. Chapter 3 contains information about commands, queries, syntax, and terminators.

You can also send measurement results directly to a printer via the interface without any PC or controller. This mode is described in Chapter 5.

Remote control of the instrument requires an interface communication configuration that matches that of your PC. Press the **INTERFACE** key to display the current configuration. Press the step keys to change the displayed configuration.

Pressing the **INTERFACE** key shows the current configuration:

Function and Key Operation	Display
INTERFACE 	Communication or Printer mode (**Co** or **Pr**)
and after 2 seconds	
	That means: baud rate 9600, data bits 8, parity no

PM6304 RS–232 INTERFACE 2 – 1

2 RS-232 INTERFACE

2.1 INSTRUMENT CONFIGURATION

All instrument functions can be controlled via the RS-232 interface.

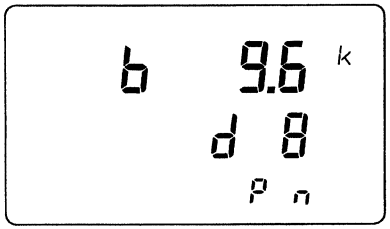
Before learning the remote interface command set, first get acquainted with the functions of the instrument, measurement setups, parameters, and limits. A detailed description with examples is in the USERS MANUAL (also in the GEBRAUCHSANLEITUNG or MODE D'EMPLOI).

The following chapter describes the functions of the RS-232 bus interface. Chapter 3 contains information about commands, queries, syntax, and terminators.

You can also send measurement results directly to a printer via the interface without any PC or controller. This mode is described in Chapter 5.

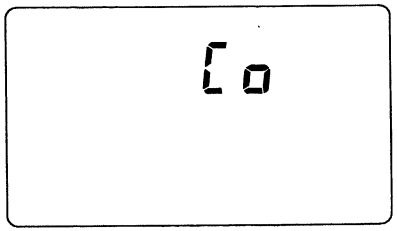
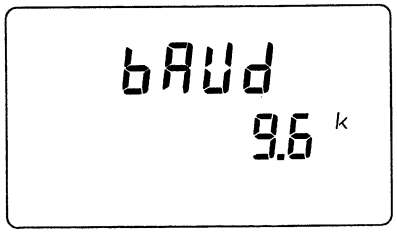
Remote control of the instrument requires an interface communication configuration that matches that of your PC. Press the **INTERFACE** key to display the current configuration. Press the step keys to change the displayed configuration.

Pressing the **INTERFACE** key shows the current configuration:

Function and Key Operation	Display
INTERFACE 	Communication or Printer mode (**Co** or **Pr**)
and after 2 seconds	
	That means: baud rate 9600, data bits 8, parity no

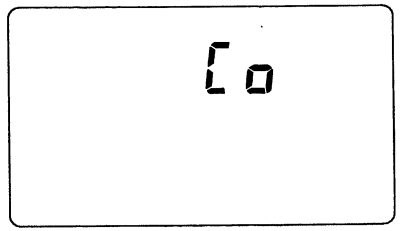
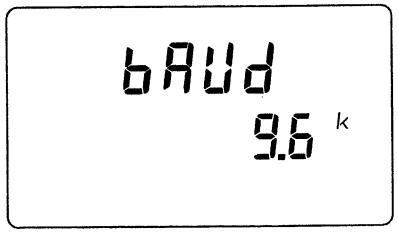
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

If you want different settings press the **INTERFACE** key again during display:

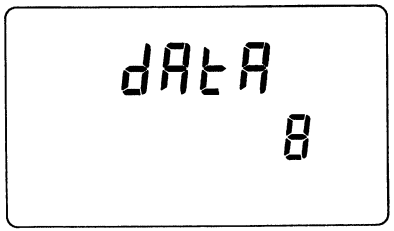
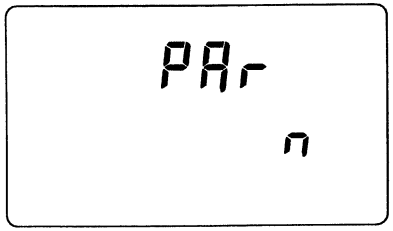
Function and Key Operation	Display
INTERFACE	
STEP – +	select operating mode **Pr** Printer mode or **Co** Communication mode
INTERFACE	
STEP – +	select baud rate **110, 150, 300, 600,** **1200, 2400, 4800, 9600, 19200** for 110 baud 2 stop bits are set, otherwise 1 stop bit

2 – 2 RS–232 INTERFACE PM6304

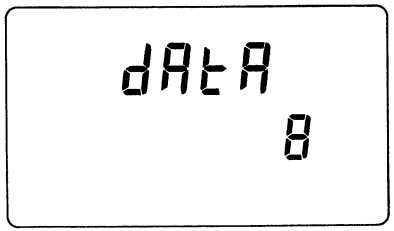
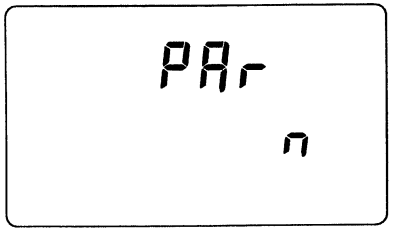
If you want different settings press the **INTERFACE** key again during display:

Function and Key Operation	Display
INTERFACE	
STEP – +	select operating mode **Pr** Printer mode or **Co** Communication mode
INTERFACE	
STEP – +	select baud rate **110, 150, 300, 600,** **1200, 2400, 4800, 9600, 19200** for 110 baud 2 stop bits are set, otherwise 1 stop bit

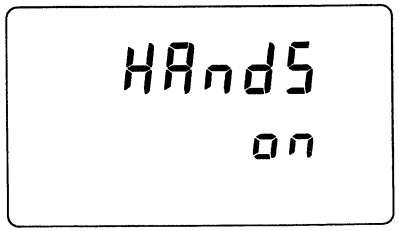
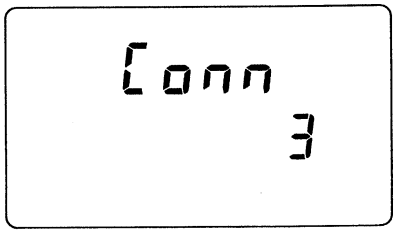
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Function and Key Operation	Display
INTERFACE	
STEP – +	select data bits **7** or **8** (7 bits for parity **E**ven or **O**dd)
INTERFACE	
STEP – +	select parity **E**ven, **O**dd or **no** (parity **no** for 8 data bits only)

PM6304 RS–232 INTERFACE 2 – 3

Function and Key Operation	Display
INTERFACE	
STEP – +	select data bits **7** or **8** (7 bits for parity **E**ven or **O**dd)
INTERFACE	
STEP – +	select parity **E**ven, **O**dd or **no** (parity **no** for 8 data bits only)

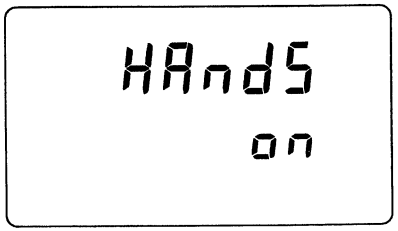
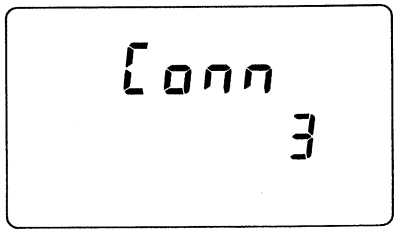
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Function and Key Operation	Display
INTERFACE	
STEP – +	select Xon/Xoff handshake **on** or **oFF**
INTERFACE	
STEP – +	select **3** or **7** wire connection

Press the **INTERFACE** key again to leave the mode.

If you do not press any key within 3 seconds during configuration, the instrument automatically returns to measuring mode, and the altered configurations are not stored.

2 – 4 RS–232 INTERFACE PM6304

Function and Key Operation	Display
INTERFACE	
STEP – +	select Xon/Xoff handshake **on** or **oFF**
INTERFACE	
STEP – +	select **3** or **7** wire connection

Press the **INTERFACE** key again to leave the mode.

If you do not press any key within 3 seconds during configuration, the instrument automatically returns to measuring mode, and the altered configurations are not stored.

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

On power up, the instrument is in 'local' mode (input via keyboard). When you set the instrument to listener mode by sending the command **ESC2** via PC, the REMOTE text appears on the display. All keys except LOCAL are locked and the instrument can now be operated in remote control. Return to local operation is done by the command **ESC 1** or by the LOCAL key. To avoid unintended local control, you can disable the LOCAL key by using the command **ESC 5**.

2.2 INTERFACE FUNCTIONS AND WIRING

Operating modes:	Communication mode, talk only mode (Printer mode)
Baud rates:	110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200
Data bits :	7 or 8
Stop bits:	1 (2 for 110 baud only)
Parity:	ODD EVEN NO (with 8 data bits)
Xon/Xoff Handshake:	ON or OFF
Hardware connection:	3 wires, no hardware handshake 7 wires, with hardware handshake
Hardware handshake:	DSR/DTR and CTS/RTS
Connector:	9-pin D-connector (male)

PM6304 RS–232 INTERFACE 2 – 5

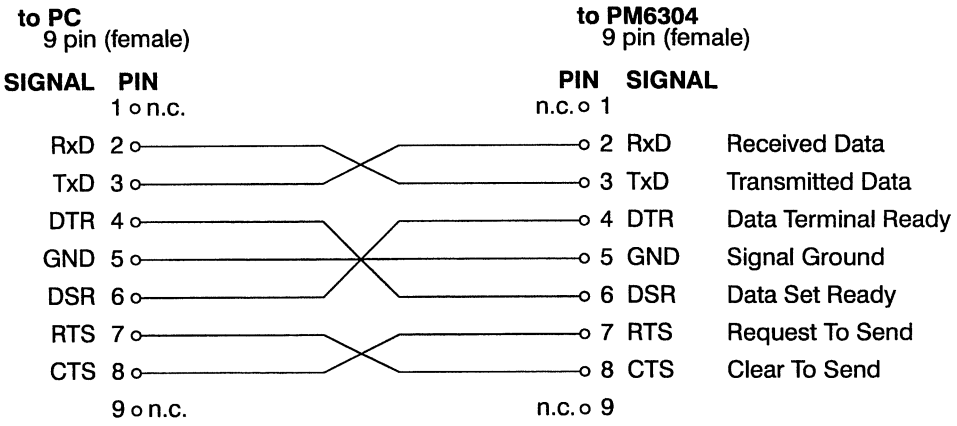
On power up, the instrument is in 'local' mode (input via keyboard). When you set the instrument to listener mode by sending the command **ESC2** via PC, the REMOTE text appears on the display. All keys except LOCAL are locked and the instrument can now be operated in remote control. Return to local operation is done by the command **ESC 1** or by the LOCAL key. To avoid unintended local control, you can disable the LOCAL key by using the command **ESC 5**.

2.2 INTERFACE FUNCTIONS AND WIRING

Operating modes:	Communication mode, talk only mode (Printer mode)
Baud rates:	110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200
Data bits :	7 or 8
Stop bits:	1 (2 for 110 baud only)
Parity:	ODD EVEN NO (with 8 data bits)
Xon/Xoff Handshake:	ON or OFF
Hardware connection:	3 wires, no hardware handshake 7 wires, with hardware handshake
Hardware handshake:	DSR/DTR and CTS/RTS
Connector:	9-pin D-connector (male)

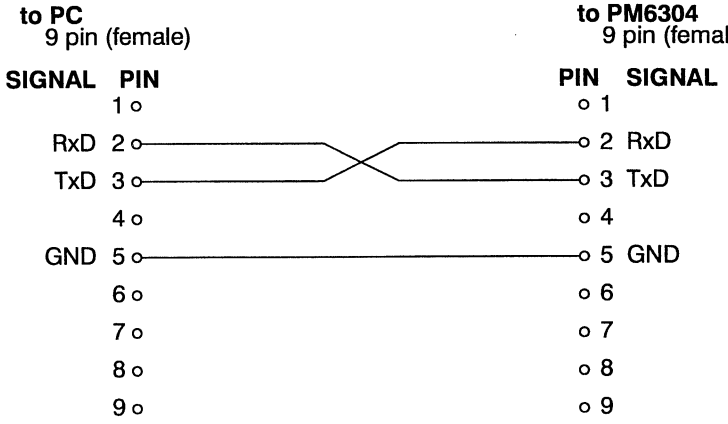
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Because the PC and the RCL Meter are DTE (Data Terminal Equipment) you should use the following pin configuration for the RS-232 connection cable. In general it is recommended that you use a well shielded cable for adequate radio interference suppression.



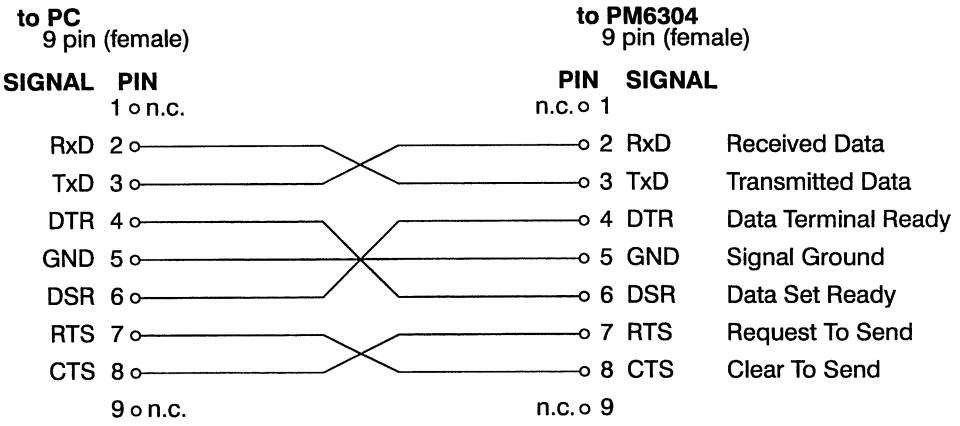
This cable can be purchased from your local Fluke organization, order number PM 9536/041.

If you use a 3-wire connection, set the PM6304 to software handshake.



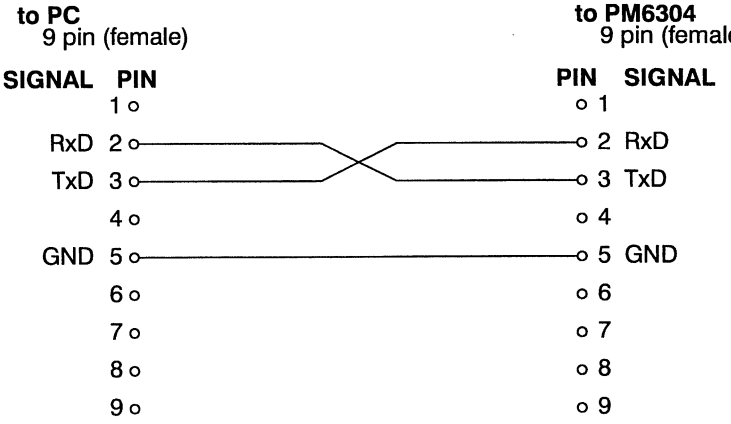
2 – 6 RS–232 INTERFACE PM6304

Because the PC and the RCL Meter are DTE (Data Terminal Equipment) you should use the following pin configuration for the RS-232 connection cable. In general it is recommended that you use a well shielded cable for adequate radio interference suppression.



This cable can be purchased from your local Fluke organization, order number PM 9536/041.

If you use a 3-wire connection, set the PM6304 to software handshake.



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

2.3 SPECIAL INTERFACE FUNCTIONS

For communication with the RS-232 interface, use the following commands (similar to the addressed and unaddressed interface commands for IEEE-488):

RS-232	Function	similar to IEEE-488
ESC 1	go to local	**GTL**
ESC 2	go to remote control	**GTR**
ESC 4	device clear	**DCL**
ESC 5	local lock out	**LLO**
ESC 7	asks for status byte	★ **STB?**
ESC 8	device trigger	**DTR**

These commands should be implemented in an application program, so they can be sent to the instrument by a PC.

PM6304 RS–232 INTERFACE 2 – 7

2.3 SPECIAL INTERFACE FUNCTIONS

For communication with the RS-232 interface, use the following commands (similar to the addressed and unaddressed interface commands for IEEE-488):

RS-232	Function	similar to IEEE-488
ESC 1	go to local	**GTL**
ESC 2	go to remote control	**GTR**
ESC 4	device clear	**DCL**
ESC 5	local lock out	**LLO**
ESC 7	asks for status byte	★ **STB?**
ESC 8	device trigger	**DTR**

These commands should be implemented in an application program, so they can be sent to the instrument by a PC.

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

REMOTE CONTROL COMMANDS

Chapter 3

REMOTE CONTROL COMMANDS

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

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

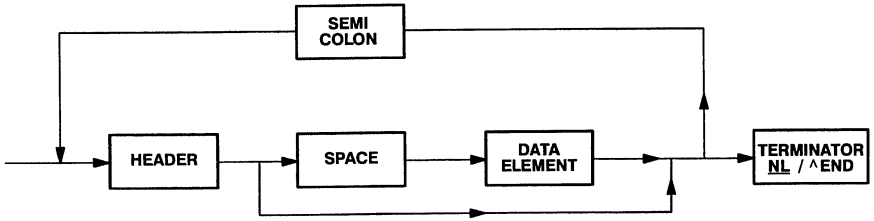
3 REMOTE CONTROL COMMANDS

In this section the commands are described as they relate to the instrument functions and front panel keys, which are listed in the Users Manual, Chapter 5, Function Reference. If not stated otherwise, following commands are used for IEEE-488 as well as for RS-232.

3.1 PROGRAM MESSAGE SYNTAX

You can combine several commands in a message and send them to the instrument, using the semicolon ";" as a separator between the commands.

Header and data element must be separated by a space; the end of a message must be terminated by NL (new line), ^END or both for the IEEE-488 interface and by NL for the RS-232 interface.



3.2 MESSAGE TERMINATOR

The instrument accepts ^END or NL (ASCII 10 dec.) or both as the terminator for a program message via the IEEE-488 interface.
The instrument also sets ^END and NL as the terminator for a response message. For compatibility to earlier controllers, you can program terminators that depart from the IEEE-488.2 standard. Use the command TRM followed by the decimal value of the required ASCII character.

Example: **TRM 13,10** sets CR NL as terminator for a response message

The command TRM without the decimal value, ★RST or the interface functions SDC/DCL sets the initial terminator again. The initial terminator is also set after power on.
Programming via the RS-232 interface uses only NL as the terminator.

PM6304 REMOTE CONTROL COMMANDS 3 – 1

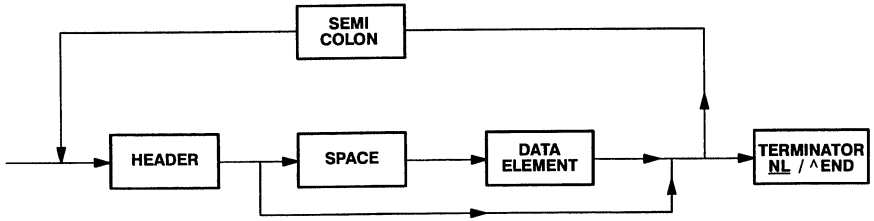
3 REMOTE CONTROL COMMANDS

In this section the commands are described as they relate to the instrument functions and front panel keys, which are listed in the Users Manual, Chapter 5, Function Reference. If not stated otherwise, following commands are used for IEEE-488 as well as for RS-232.

3.1 PROGRAM MESSAGE SYNTAX

You can combine several commands in a message and send them to the instrument, using the semicolon ";" as a separator between the commands.

Header and data element must be separated by a space; the end of a message must be terminated by NL (new line), ^END or both for the IEEE-488 interface and by NL for the RS-232 interface.



3.2 MESSAGE TERMINATOR

The instrument accepts ^END or NL (ASCII 10 dec.) or both as the terminator for a program message via the IEEE-488 interface.
The instrument also sets ^END and NL as the terminator for a response message. For compatibility to earlier controllers, you can program terminators that depart from the IEEE-488.2 standard. Use the command TRM followed by the decimal value of the required ASCII character.

Example: **TRM 13,10** sets CR NL as terminator for a response message

The command TRM without the decimal value, ★RST or the interface functions SDC/DCL sets the initial terminator again. The initial terminator is also set after power on.
Programming via the RS-232 interface uses only NL as the terminator.

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

3.3 SERVICE REQUEST (SRQ) AND STATUS REGISTERS

A Service Request will be generated if one or more bits of the 'Status Byte Register' are set to 1 and if the corresponding bits are enabled by the 'Service Request Enable Register' (IEEE-488 interface only). The controller asks the contents of the 'Status Byte Register' in 'Serial Poll Mode.'

PM6304 'Status Byte Register':

Bit	Function	Decimal Value
0	not used	1
1		2
2		4
3		8
4	message available (MAV)	16
5	bit of the 'Standard Event Status Register' high	32
6	request for service (RSQ)	64
7	not used	128

To get the information via Service Request that bits of the 'Standard Event Status Register' are set, those bits must have been enabled by ⋆ESE, **and** bit 5 of the 'Status Byte Register' must have been enabled by ⋆SRE.

Direct readout without Service Request is possible for the IEEE-488 as well as for the RS-232 interface by using the ⋆ESR? query for the 'Standard Event Status Register' and by the ⋆STB? query for the 'Status Byte Register.'

3 – 2 REMOTE CONTROL COMMANDS PM6304

3.3 SERVICE REQUEST (SRQ) AND STATUS REGISTERS

A Service Request will be generated if one or more bits of the 'Status Byte Register' are set to 1 and if the corresponding bits are enabled by the 'Service Request Enable Register' (IEEE-488 interface only). The controller asks the contents of the 'Status Byte Register' in 'Serial Poll Mode.'

PM6304 'Status Byte Register':

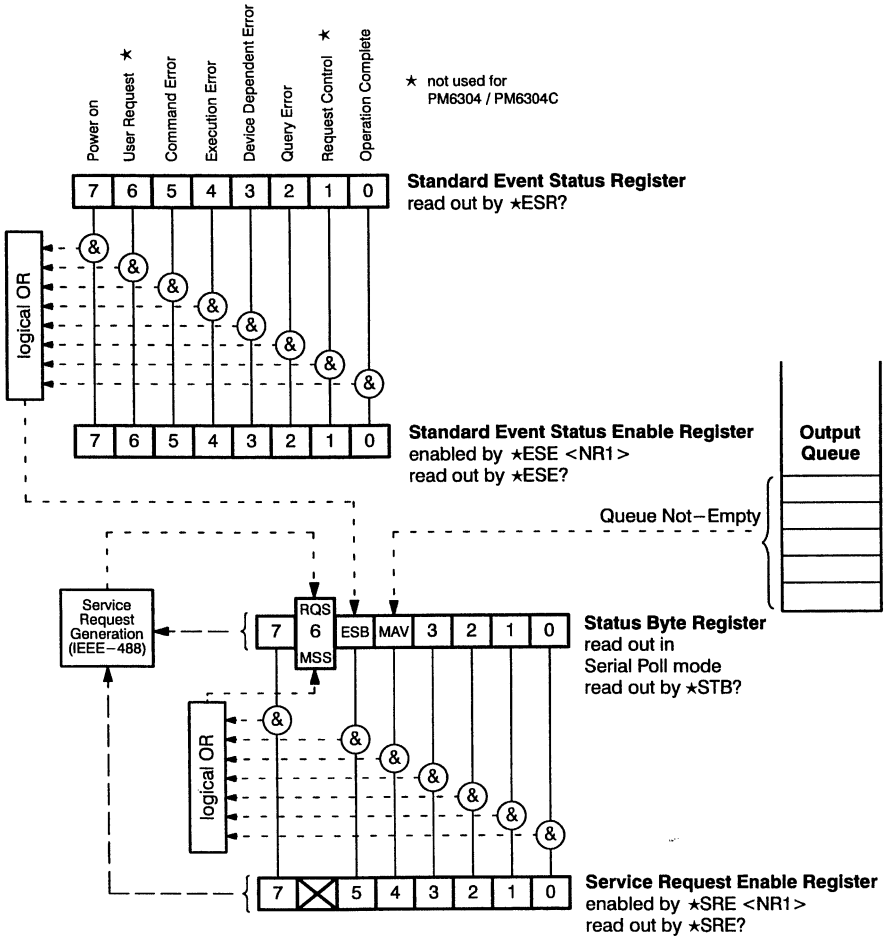
Bit	Function	Decimal Value
0	not used	1
1		2
2		4
3		8
4	message available (MAV)	16
5	bit of the 'Standard Event Status Register' high	32
6	request for service (RSQ)	64
7	not used	128

To get the information via Service Request that bits of the 'Standard Event Status Register' are set, those bits must have been enabled by ⋆ESE, **and** bit 5 of the 'Status Byte Register' must have been enabled by ⋆SRE.

Direct readout without Service Request is possible for the IEEE-488 as well as for the RS-232 interface by using the ⋆ESR? query for the 'Standard Event Status Register' and by the ⋆STB? query for the 'Status Byte Register.'

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

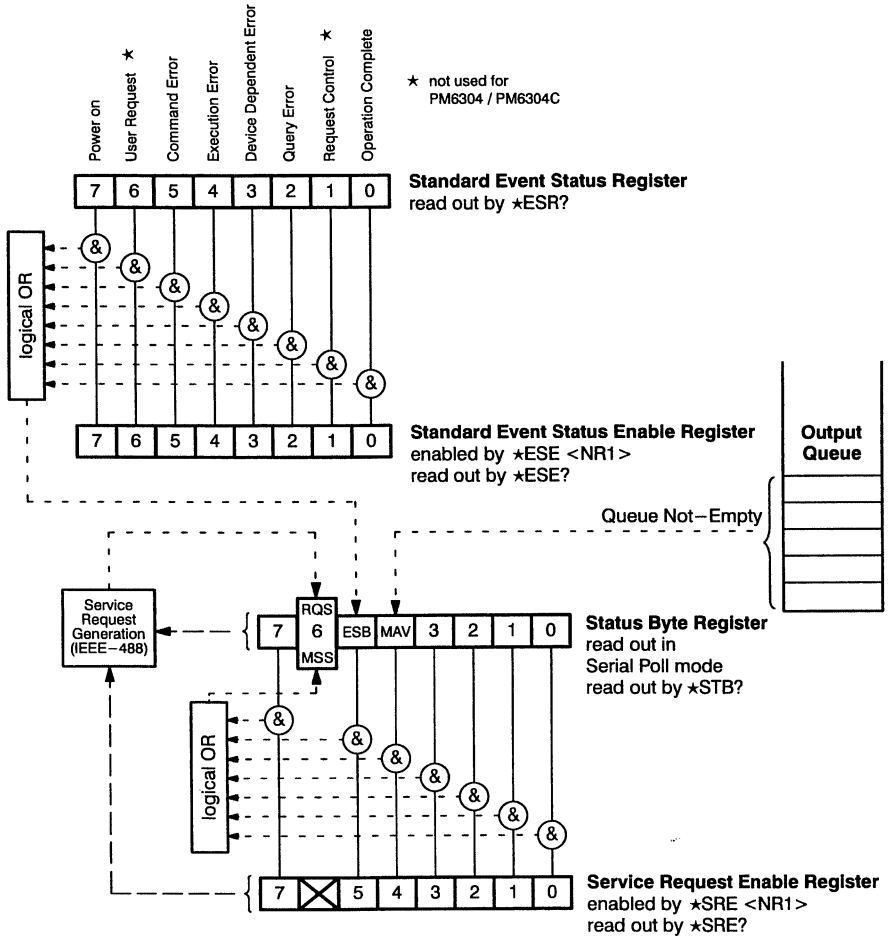
PM6304 / PM6304C 'Standard Event Status Register'



<NR1> represents a decimal value. The binary pattern of the decimal value sets the corresponding bits of the 'Enable Registers' to 1, which enables the bits of the 'Status Registers'.
All bits of the 'Standard Event Status Enable Register' and the 'Service Request Enable Register' are automatically set to 0 when powering up the instrument. Therefore, in a user program it is necessary that the required bits are set to 1 after power-on, if Service Request is required.

PM6304 REMOTE CONTROL COMMANDS 3 – 3

PM6304 / PM6304C 'Standard Event Status Register'



<NR1> represents a decimal value. The binary pattern of the decimal value sets the corresponding bits of the 'Enable Registers' to 1, which enables the bits of the 'Status Registers'.
All bits of the 'Standard Event Status Enable Register' and the 'Service Request Enable Register' are automatically set to 0 when powering up the instrument. Therefore, in a user program it is necessary that the required bits are set to 1 after power-on, if Service Request is required.

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

3.4 COMMON COMMANDS (IEEE-488.2)

System Data:

⋆IDN? Identification Query
After receipt of this query, the instrument generates the following response message:
FLUKE,PM6304,0,Vx.x/0000 x.x = software status

⋆LRN? Learn Device Setup Query
After receipt of the query the PM 6304 generates a response message which comprises the complete actual instrument setups. This message can be read in by a controller, stored in a program and be re-sent as a program command message to the instrument later on. By this method, manual keyboard inputs can be read into a program.

Internal Operations:

⋆RST Reset Command
This command performs a reset, which sets the instrument to a default status:

Measuring mode:	AUTO
Test signal:	AC
Measurements:	CONTINUOUS
Average:	OFF (normal)
Test signal frequency:	1 kHz
Test signal level:	NORMAL (1 V)
DC bias:	OFF
Fast measurement:	OFF
Range Hold:	OFF

The reset does not affect the internal memories of the instrument, the enable registers, or the status registers of the interface.

3 – 4 REMOTE CONTROL COMMANDS PM6304

3.4 COMMON COMMANDS (IEEE-488.2)

System Data:

⋆IDN? Identification Query
After receipt of this query, the instrument generates the following response message:
FLUKE,PM6304,0,Vx.x/0000 x.x = software status

⋆LRN? Learn Device Setup Query
After receipt of the query the PM 6304 generates a response message which comprises the complete actual instrument setups. This message can be read in by a controller, stored in a program and be re-sent as a program command message to the instrument later on. By this method, manual keyboard inputs can be read into a program.

Internal Operations:

⋆RST Reset Command
This command performs a reset, which sets the instrument to a default status:

Measuring mode:	AUTO
Test signal:	AC
Measurements:	CONTINUOUS
Average:	OFF (normal)
Test signal frequency:	1 kHz
Test signal level:	NORMAL (1 V)
DC bias:	OFF
Fast measurement:	OFF
Range Hold:	OFF

The reset does not affect the internal memories of the instrument, the enable registers, or the status registers of the interface.

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

⋆TST? Self-test Query

The instrument automatically checks the RAM and the EEPROM. The contents of the register will not be destroyed, and instrument settings remain unchanged. The test lasts approximately 1 second.

A zero in the response indicates that the self-test has completed without errors detected.

In case of an error, one of the following digits is displayed:

1 = error during RAM test
2 = error in storage register 0
3 = error in other storage registers
4 = EEPROM defective
8 = calibration data not valid
12 = trimming data not valid
16 = bin data not valid
32 = line frequency identification defective
64 = no trimming data
128 = no calibration data

If the test detects more than one error, the sum of the single error numbers is displayed.

Synchronization:

⋆OPC Operating Complete Command

For PM6304, this command is suggested only for single measurements, trimming, calibration, and when the test signal has been altered (HIGH, NORMAL, LOW, DC, AC). Selecting one of these functions via the IEEE-488 bus, followed by the command ⋆OPC in the same string, sets bit 0 (operation complete) of the 'Standard Event Status Register' to 1 when the function is finished. This bit activates bit 5 of the 'Status Byte Register' (Event Status Bit), which generates a Service Request. This alerts the controller that the function is finished. See Section 3.3 to enable the Service Request.

PM6304 REMOTE CONTROL COMMANDS 3 – 5

⋆TST? Self-test Query

The instrument automatically checks the RAM and the EEPROM. The contents of the register will not be destroyed, and instrument settings remain unchanged. The test lasts approximately 1 second.

A zero in the response indicates that the self-test has completed without errors detected.

In case of an error, one of the following digits is displayed:

1 = error during RAM test
2 = error in storage register 0
3 = error in other storage registers
4 = EEPROM defective
8 = calibration data not valid
12 = trimming data not valid
16 = bin data not valid
32 = line frequency identification defective
64 = no trimming data
128 = no calibration data

If the test detects more than one error, the sum of the single error numbers is displayed.

Synchronization:

⋆OPC Operating Complete Command

For PM6304, this command is suggested only for single measurements, trimming, calibration, and when the test signal has been altered (HIGH, NORMAL, LOW, DC, AC). Selecting one of these functions via the IEEE-488 bus, followed by the command ⋆OPC in the same string, sets bit 0 (operation complete) of the 'Standard Event Status Register' to 1 when the function is finished. This bit activates bit 5 of the 'Status Byte Register' (Event Status Bit), which generates a Service Request. This alerts the controller that the function is finished. See Section 3.3 to enable the Service Request.

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

Example: **TRIG;⋆OPC**
causes the instrument to set bit 0 of the 'Standard Event Status Register' to 1 when the operation (single measurement) is completed.
When the instrument is externally triggered, it is recommended you send ⋆OPC alone. Bit 0 is set to 1 when the externally triggered measurement is finished.
If ⋆OPC is sent when the operation is already finished bit 0 is not set to 1.

⋆OPC? Operation Complete Query
This command also works well for single measurements, trimming, and calibration. Sending the query ⋆OPC? to the generator during a running function causes the instrument to wait until the function is finished, and then set a 1 in the output queue. The register can be read out by the controller without a Service Request. When a 1 is returned, your user program can then continue.

Data in the output queue activates bit 4 of the 'Status Byte Register' (MAV, message available), which may generate Service Request. To avoid generating an SRQ, disable bit 4 (set it to 0). Bit 0 (operation complete) of the 'Standard Event Status Register' is not affected by ⋆OPC?

Contrary to ⋆OPC, the query ⋆OPC? is more convenient for the RS-232 interface because the 1 is directly sent; a separate read-out is not necessary as it would be for the IEEE-488 interface.
If ⋆OPC? is sent when the operation is already finished, bit 0 is not set to 1.

⋆WAI Wait-to-Continue Command
This command sent to the instrument in a message string with other commands causes the instrument to execute the command following ⋆WAI only when the previous command is completed.

Example: **TRIG;⋆WAI;COMP?**
In single measurement mode this message causes the instrument to wait until the measurement is finished; after that it sends the result. This avoids a readout of the stored values of the previous measurement.
The message SINGL;⋆WAI;COMP? is only applicable for external trigger; the command TRIG via interface is not accepted in this case.
Sending ⋆WAI alone or at the end of a string could stop the communication via the interface.

3 – 6 REMOTE CONTROL COMMANDS PM6304

Example: **TRIG;⋆OPC**
causes the instrument to set bit 0 of the 'Standard Event Status Register' to 1 when the operation (single measurement) is completed.
When the instrument is externally triggered, it is recommended you send ⋆OPC alone. Bit 0 is set to 1 when the externally triggered measurement is finished.
If ⋆OPC is sent when the operation is already finished bit 0 is not set to 1.

⋆OPC? Operation Complete Query
This command also works well for single measurements, trimming, and calibration. Sending the query ⋆OPC? to the generator during a running function causes the instrument to wait until the function is finished, and then set a 1 in the output queue. The register can be read out by the controller without a Service Request. When a 1 is returned, your user program can then continue.

Data in the output queue activates bit 4 of the 'Status Byte Register' (MAV, message available), which may generate Service Request. To avoid generating an SRQ, disable bit 4 (set it to 0). Bit 0 (operation complete) of the 'Standard Event Status Register' is not affected by ⋆OPC?

Contrary to ⋆OPC, the query ⋆OPC? is more convenient for the RS-232 interface because the 1 is directly sent; a separate read-out is not necessary as it would be for the IEEE-488 interface.
If ⋆OPC? is sent when the operation is already finished, bit 0 is not set to 1.

⋆WAI Wait-to-Continue Command
This command sent to the instrument in a message string with other commands causes the instrument to execute the command following ⋆WAI only when the previous command is completed.

Example: **TRIG;⋆WAI;COMP?**
In single measurement mode this message causes the instrument to wait until the measurement is finished; after that it sends the result. This avoids a readout of the stored values of the previous measurement.
The message SINGL;⋆WAI;COMP? is only applicable for external trigger; the command TRIG via interface is not accepted in this case.
Sending ⋆WAI alone or at the end of a string could stop the communication via the interface.

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

⋆TRG Trigger Command
When receiving ⋆TRG, the instrument starts a measurement in single measurement mode (see Page 3 – 14 to set instrument for single measurement mode).

Status and Event:

⋆CLS Clear Status Command
Sets bits of the 'Standard Event Status Register' and of the 'Status Byte Register' to zero. Sending ⋆CLS as a single command or as the first command of a string also clears the contents of the Output Queue.

⋆ESE Standard Event Status Enable Command
⋆ESE, followed by a decimal value, sets the bits of the 'Standard Event Status Enable Register'. For more detail on the assigned bits of the 'Standard Event Status Register,' see Section 3.3.

⋆ESE? Standard Event Status Enable Query
This query asks the instrument for the contents of the 'Standard Event Status Enable Register'. The response is a decimal value.

Example: "255 = all bits are set to 1: all events of the 'Standard Event Status Register' are enabled.

⋆ESR? Standard Event Status Register Query
Asks for the contents of the 'Standard Event Status Register.' The response is a decimal value. This query also clears the register contents.

⋆SRE Service Request Enable Command
⋆SRE, followed by a decimal value, sets the bits to 1 of the 'Service Request Enable Register,' except bit 6. For more detail on the assigned bits of the 'Status Byte Register', see Section 3.3.

⋆SRE? Service Request Enable Query
Asks for the contents of the 'Service Request Enable Register.' The response is a decimal value.

PM6304 REMOTE CONTROL COMMANDS 3 – 7

⋆TRG Trigger Command
When receiving ⋆TRG, the instrument starts a measurement in single measurement mode (see Page 3 – 14 to set instrument for single measurement mode).

Status and Event:

⋆CLS Clear Status Command
Sets bits of the 'Standard Event Status Register' and of the 'Status Byte Register' to zero. Sending ⋆CLS as a single command or as the first command of a string also clears the contents of the Output Queue.

⋆ESE Standard Event Status Enable Command
⋆ESE, followed by a decimal value, sets the bits of the 'Standard Event Status Enable Register'. For more detail on the assigned bits of the 'Standard Event Status Register,' see Section 3.3.

⋆ESE? Standard Event Status Enable Query
This query asks the instrument for the contents of the 'Standard Event Status Enable Register'. The response is a decimal value.

Example: "255 = all bits are set to 1: all events of the 'Standard Event Status Register' are enabled.

⋆ESR? Standard Event Status Register Query
Asks for the contents of the 'Standard Event Status Register.' The response is a decimal value. This query also clears the register contents.

⋆SRE Service Request Enable Command
⋆SRE, followed by a decimal value, sets the bits to 1 of the 'Service Request Enable Register,' except bit 6. For more detail on the assigned bits of the 'Status Byte Register', see Section 3.3.

⋆SRE? Service Request Enable Query
Asks for the contents of the 'Service Request Enable Register.' The response is a decimal value.

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

⋆STB? Read Status Byte Query
Asks for the contents of the 'Status Byte Register.' The response is a decimal value.

Sending this query via IEEE-488 interface causes the PM 6304 to set bit 4 (MAV) of the Status Byte Register. The output is 16 dec if no further bits are set.

Save and Recall Instrument Settings:

⋆SAV Save Command
This command, followed by a decimal value from 1 to 9, stores the current instrument setting including trimming data into the corresponding internal memory register. The contents of the memory are not affected by the command ⋆RST or when the instrument is turned off.

⋆RCL Recall Command
This command followed by a decimal value from 1 to 9 for the memory place calls up and executes the instrument setting stored in that memory register. Trim data are also recalled.

3.5 DEVICE SPECIFIC MESSAGES

This section contains the remote programming commands necessary to select operation modes and parameters and to read out measurement values.

Numeric entry
<NRf> flexible numeric representation
Under the IEEE-488.2 standard, numeric values can be given to the instrument in integer <NR1>, real <NR2>, or exponential <NR3> forms. The number of digits is limited to 10 for mantissa and 2 for the exponent. The dimension (**Hz, F, H,** Ω, **V, I,** or **degrees**) is automatically set by the instrument.

3 – 8 REMOTE CONTROL COMMANDS PM6304

⋆STB? Read Status Byte Query
Asks for the contents of the 'Status Byte Register.' The response is a decimal value.

Sending this query via IEEE-488 interface causes the PM 6304 to set bit 4 (MAV) of the Status Byte Register. The output is 16 dec if no further bits are set.

Save and Recall Instrument Settings:

⋆SAV Save Command
This command, followed by a decimal value from 1 to 9, stores the current instrument setting including trimming data into the corresponding internal memory register. The contents of the memory are not affected by the command ⋆RST or when the instrument is turned off.

⋆RCL Recall Command
This command followed by a decimal value from 1 to 9 for the memory place calls up and executes the instrument setting stored in that memory register. Trim data are also recalled.

3.5 DEVICE SPECIFIC MESSAGES

This section contains the remote programming commands necessary to select operation modes and parameters and to read out measurement values.

Numeric entry
<NRf> flexible numeric representation
Under the IEEE-488.2 standard, numeric values can be given to the instrument in integer <NR1>, real <NR2>, or exponential <NR3> forms. The number of digits is limited to 10 for mantissa and 2 for the exponent. The dimension (**Hz, F, H,** Ω, **V, I,** or **degrees**) is automatically set by the instrument.

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

You can set the test frequency, for example, to 1 kHz with following inputs for <NRf>:

FREQUENCY 1.000e3	
FREQUENCY 1000	
FREQUENCY 1000.0	
FREQUENCY 1E3	
FREQUENCY 1000.1	instrument rounds to its nearest available frequency which is 1 kHz

Some headers can be sent as command headers to program the instrument and also as queries by adding a question mark. The instrument returns its actual setting in response to the query.

Example:	FREQUENCY 1E3	sets the test signal frequency to 1 kHz
	FREQUENCY?	response: FREQ 1.0E3

Sending several queries in a single string could cause an error message if the answer exceeds 31 characters.

Most headers can be used in short form, marked with bold letters in the table.

Example: **AV**ERAGE **ON** in short forms **AVG ON**

3.5.1 Instrument Settings and Measurements

3.5.1.1 Measuring Modes

In most cases, you will be interested in the dominant parameter of the component. This is automatically determined in the AUTO mode. The display shows AUTO, the value of the dominant parameter in the upper line, the value of the secondary parameter in the lower line and the appropiate equivalent circuit symbol.
If you want to determine a parameter that differs from the automatically determined by the instrument, select SERIAL or PARALLEL MODE.

PM6304 REMOTE CONTROL COMMANDS 3 – 9

You can set the test frequency, for example, to 1 kHz with following inputs for <NRf>:

FREQUENCY 1.000e3	
FREQUENCY 1000	
FREQUENCY 1000.0	
FREQUENCY 1E3	
FREQUENCY 1000.1	instrument rounds to its nearest available frequency which is 1 kHz

Some headers can be sent as command headers to program the instrument and also as queries by adding a question mark. The instrument returns its actual setting in response to the query.

Example:	FREQUENCY 1E3	sets the test signal frequency to 1 kHz
	FREQUENCY?	response: FREQ 1.0E3

Sending several queries in a single string could cause an error message if the answer exceeds 31 characters.

Most headers can be used in short form, marked with bold letters in the table.

Example: **AV**ERAGE **ON** in short forms **AVG ON**

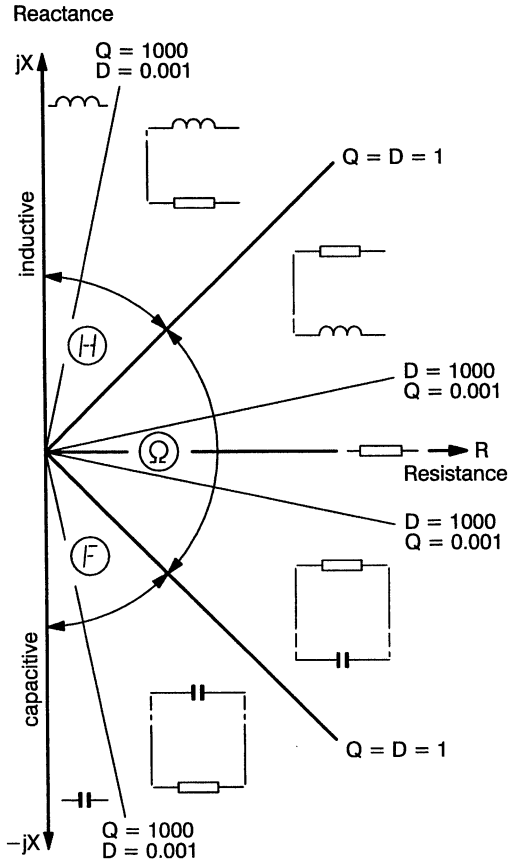
3.5.1 Instrument Settings and Measurements

3.5.1.1 Measuring Modes

In most cases, you will be interested in the dominant parameter of the component. This is automatically determined in the AUTO mode. The display shows AUTO, the value of the dominant parameter in the upper line, the value of the secondary parameter in the lower line and the appropiate equivalent circuit symbol.
If you want to determine a parameter that differs from the automatically determined by the instrument, select SERIAL or PARALLEL MODE.

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

Auto Mode Desicion Diagram



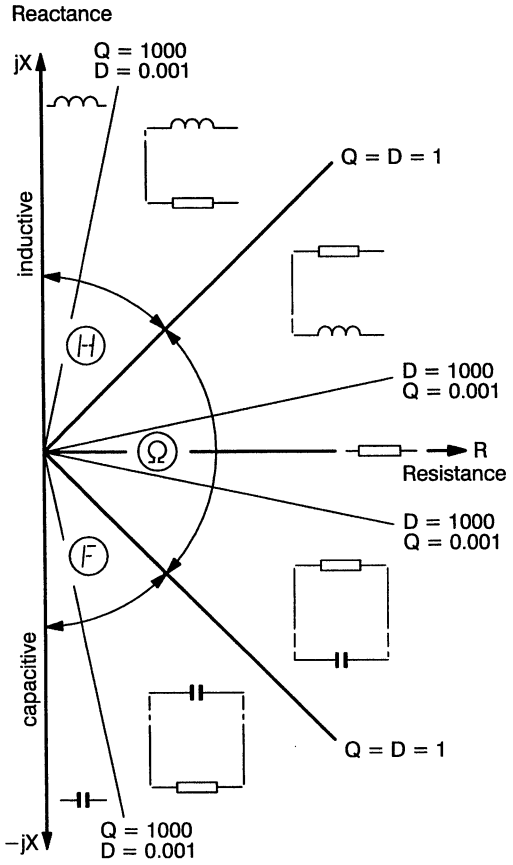
Commands:
MODE **AUTO**
MODE **SER**IAL
MODE **PARAL**

Query:
MODE?

Response:
MODE AUTO
MODE AUTO SER
MODE AUTO PAR
MODE SER
MODE PAR

3 – 10 REMOTE CONTROL COMMANDS PM6304

Auto Mode Desicion Diagram



Commands:
MODE **AUTO**
MODE **SER**IAL
MODE **PARAL**

Query:
MODE?

Response:
MODE AUTO
MODE AUTO SER
MODE AUTO PAR
MODE SER
MODE PAR

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

3.5.1.2 Parameters

You also can select certain parameters to be displayed, for example, phase angle, quality factor, impedance, etc.

Commands:	**PARAM QUA**LITY	quality factor
	PARAM DISSIPATION	dissipation factor
	PARAM PHASE	phase angle
	PARAM IMPEDANCE	impedance
	PARAM VOLTAGE	measured voltage
	PARAM CURRENT	measured current
	PARAM AUTO	measurement selected before (AUTO, SER or PARAL)
Query:	**PARAM**ETER?	
Response:	PARAM QUA	
	PARAM DISS	
	PARAM PHA	
	PARAM IMP	
	PARAM VOL	
	PARAM CUR	
	PARAM AUTO	

To read out measured values see Section 3.5.1.7.

PM6304 REMOTE CONTROL COMMANDS 3 – 11

3.5.1.2 Parameters

You also can select certain parameters to be displayed, for example, phase angle, quality factor, impedance, etc.

Commands: PARAM QUALITY quality factor
PARAM DISSIPATION dissipation factor
PARAM PHASE phase angle
PARAM IMPEDANCE impedance
PARAM VOLTAGE measured voltage
PARAM CURRENT measured current
PARAM AUTO measurement selected before (AUTO, SER or PARAL)

Query: PARAMETER?

Response: PARAM QUA
PARAM DISS
PARAM PHA
PARAM IMP
PARAM VOL
PARAM CUR
PARAM AUTO

To read out measured values see Section 3.5.1.7.

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

3.5.1.3 Zero Trim

If you measure low-resistance components (i.e., less than 100 Ω), or small inductances (i.e., less than 100 nH) short circuit the connection sockets and perform trimming.

For measuring small capacitances (i.e. less than 200 pF) or high resistances, perform trimming with open connection sockets.

For detailed information see the Users Manual, Section 4.3.

Commands: **TRIM**

Query: none

Response: none

If the trim fails, the instrument generates an error message.

3.5.1.4 Test Signal

You can select an AC test signal with different frequencies or a DC test signal (option). If you want to send a query for measurement results after you change the test signal, allow the instrument to set the new settings, see ⋆OPC(?) and ⋆WAI, Section 3.4.

Test signal AC/DC

Commands: **TEST_SIG**NAL **AC**
TEST_SIGNAL **DC**

Query: **TEST_SIG**NAL**?**

Response: TEST_SIG AC
TEST_SIG DC

3 – 12 REMOTE CONTROL COMMANDS PM6304

3.5.1.3 Zero Trim

If you measure low-resistance components (i.e., less than 100 Ω), or small inductances (i.e., less than 100 nH) short circuit the connection sockets and perform trimming.

For measuring small capacitances (i.e. less than 200 pF) or high resistances, perform trimming with open connection sockets.

For detailed information see the Users Manual, Section 4.3.

Commands: **TRIM**

Query: none

Response: none

If the trim fails, the instrument generates an error message.

3.5.1.4 Test Signal

You can select an AC test signal with different frequencies or a DC test signal (option). If you want to send a query for measurement results after you change the test signal, allow the instrument to set the new settings, see ⋆OPC(?) and ⋆WAI, Section 3.4.

Test signal AC/DC

Commands: **TEST_SIG**NAL **AC**
TEST_SIGNAL **DC**

Query: **TEST_SIG**NAL**?**

Response: TEST_SIG AC
TEST_SIG DC

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

Test signal frequency

You can select following frequencies:

50 Hz, 60, 100, 120, 200, 300, 400 Hz ... 19.9 kHz, 20 kHz, 100 kHz

If you select different values, the instrument automatically rounds to the next valid frequency value.

Commands: **FRE**QUENCY <NRf> NRf = values see above

Query: **FRE**QUENCY**?**

Response: FREQ <NR1> or <NR3>

Test signal level

You can select following test signal voltages:

AC voltage	2 V,	400 Ω internal resistance	(HIGH LEVEL)
	1 V,	100 Ω internal resistance	(NORMAL LEVEL)
	50 mV,	100 Ω internal resistance	(LOW LEVEL)
DC voltage	2 V,	400 Ω internal resistance	(HIGH LEVEL)
	1 V,	100 Ω internal resistance	(NORMAL LEVEL)
	300 mV,	100 Ω internal resistance	(LOW LEVEL)

Commands: **LEV**EL **HI**GH
LEVEL **NO**RMAL
LEVEL **LO**W

Query: **LEV**EL**?**

Response: LEVEL HI
LEVEL NO
LEVEL LO

PM6304 REMOTE CONTROL COMMANDS 3 – 13

Test signal frequency

You can select following frequencies:

50 Hz, 60, 100, 120, 200, 300, 400 Hz ... 19.9 kHz, 20 kHz, 100 kHz

If you select different values, the instrument automatically rounds to the next valid frequency value.

Commands: **FRE**QUENCY <NRf> NRf = values see above

Query: **FRE**QUENCY**?**

Response: FREQ <NR1> or <NR3>

Test signal level

You can select following test signal voltages:

AC voltage	2 V,	400 Ω internal resistance	(HIGH LEVEL)
	1 V,	100 Ω internal resistance	(NORMAL LEVEL)
	50 mV,	100 Ω internal resistance	(LOW LEVEL)
DC voltage	2 V,	400 Ω internal resistance	(HIGH LEVEL)
	1 V,	100 Ω internal resistance	(NORMAL LEVEL)
	300 mV,	100 Ω internal resistance	(LOW LEVEL)

Commands: **LEV**EL **HI**GH
LEVEL **NO**RMAL
LEVEL **LO**W

Query: **LEV**EL**?**

Response: LEVEL HI
LEVEL NO
LEVEL LO

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

3.5.1.5 DC Bias

You can add an internal 2 V bias voltage or an external one of maximum 40 V to the AC test signal voltage.

Commands: **DC_BIAS OFF**
DC_BIAS INT
DC_BIAS EXT

Query: **DC_BIAS?**

Response: DC_BIAS OFF
DC_BIAS INT
DC_BIAS EXT

3.5.1.6 Measuring Types

For normal measurement you should select continuous measurement.

For binning or using the instrument for checking in automatic systems you should select single measurements. This allows you to remove or to insert components and to start a measurement at a defined moment.

You can increase the measurement speed up to 10 measurements per second. The measurement results are returned via remote interface only. The display shows FAST, and the measured values can be read out by the controller (IEEE-488 interface). When you use the RS-232 interface, the value is sent directly to the computer.

In FAST mode different tolerances are valid. See Reference Manual, Chapter 1.

3 – 14 REMOTE CONTROL COMMANDS PM6304

3.5.1.5 DC Bias

You can add an internal 2 V bias voltage or an external one of maximum 40 V to the AC test signal voltage.

Commands: DC_BIAS OFF
DC_BIAS INT
DC_BIAS EXT

Query: DC_BIAS?

Response: DC_BIAS OFF
DC_BIAS INT
DC_BIAS EXT

3.5.1.6 Measuring Types

For normal measurement you should select continuous measurement.

For binning or using the instrument for checking in automatic systems you should select single measurements. This allows you to remove or to insert components and to start a measurement at a defined moment.

You can increase the measurement speed up to 10 measurements per second. The measurement results are returned via remote interface only. The display shows FAST, and the measured values can be read out by the controller (IEEE-488 interface). When you use the RS-232 interface, the value is sent directly to the computer.

In FAST mode different tolerances are valid. See Reference Manual, Chapter 1.

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

The following test signal frequencies are available in fast mode:
200 Hz, 400 Hz ... 19.6 kHz, 19.8 kHz, 20 kHz, 100 kHz, or DC.

If you select a different frequency via interface or keyboard the instrument sets to the next lower frequency.

Continuous or single measurements

Commands: **CON**TIN
SINGLE

Query: **TRIG?**

Response: CONTIN
SINGLE

Start a single measurement

Commands: **TRIG**GER

Query: **TRIG**GER?

Response: CONTIN
SINGLE

Fast measurement

Commands: **MEA**S_**FAST ON**
MEAS_**FAST OFF**

Query: **MEA**S_**FAST?**

Response: MEAS_FAST ON
MEAS_FAST OFF

PM6304 REMOTE CONTROL COMMANDS 3 – 15

The following test signal frequencies are available in fast mode:
200 Hz, 400 Hz ... 19.6 kHz, 19.8 kHz, 20 kHz, 100 kHz, or DC.

If you select a different frequency via interface or keyboard the instrument sets to the next lower frequency.

Continuous or single measurements

Commands: **CON**TIN
SINGLE

Query: **TRIG?**

Response: CONTIN
SINGLE

Start a single measurement

Commands: **TRIG**GER

Query: **TRIG**GER?

Response: CONTIN
SINGLE

Fast measurement

Commands: **MEA**S_**FAST ON**
MEAS_**FAST OFF**

Query: **MEA**S_**FAST?**

Response: MEAS_FAST ON
MEAS_FAST OFF

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

Note:

- FAST measurement is possible only in SINGLE mode.
- The instrument measures the value of the dominant parameter or of the parameter selected by PARAM ... .
- The measured value and the bin number must be read out by a controller without query when the measurement is finished.
- Instrument settings cannot be stored.
- The command TRIM or BIN_RCL <NRf> switches off FAST measurement.
- When you switch to LOCAL, the instrument returns to FAST measurement OFF. When you combine FAST measurement and Binning, the instrument remains in this mode when you switch to LOCAL; so you can bin in FAST measurement mode without a PC.
- In FAST measurement mode the bin 0 output of the Handler Interface provides a timing signal for an external component handler; see Reference Manual, Section 1.6.
- If you trigger externally in FAST measurement mode, avoid contact bouncing.

3.5.1.7 Queries for measured values

Query:	**COM**PONENT?	askes for dominant and secondary parameter shown in the display
	RESISTANCE?	
	CAPACITANCE?	
	INDUCTANCE?	
	IMPEDANCE?	
	QUALITY?	
	DISSIPATION?	
	PHASE?	
	VOLTAGE?	
	CURRENT?	

3 – 16 REMOTE CONTROL COMMANDS PM6304

Note:

- FAST measurement is possible only in SINGLE mode.
- The instrument measures the value of the dominant parameter or of the parameter selected by PARAM ... .
- The measured value and the bin number must be read out by a controller without query when the measurement is finished.
- Instrument settings cannot be stored.
- The command TRIM or BIN_RCL <NRf> switches off FAST measurement.
- When you switch to LOCAL, the instrument returns to FAST measurement OFF. When you combine FAST measurement and Binning, the instrument remains in this mode when you switch to LOCAL; so you can bin in FAST measurement mode without a PC.
- In FAST measurement mode the bin 0 output of the Handler Interface provides a timing signal for an external component handler; see Reference Manual, Section 1.6.
- If you trigger externally in FAST measurement mode, avoid contact bouncing.

3.5.1.7 Queries for measured values

Query: COMPONENT? askes for dominant and secondary parameter shown in the display
RESISTANCE?
CAPACITANCE?
INDUCTANCE?
IMPEDANCE?
QUALITY?
DISSIPATION?
PHASE?
VOLTAGE?
CURRENT?

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

Responses for COM?

Dominant ; secondary parameter in Auto mode in accordance with the Auto Mode Decision Diagram, Section 3.5.1.1.
If a certain parameter has been selected with the LOCK command, this parameter is shown at first, regardless of whether or not it is the dominant one.

L	<NRf>	
L	<NRf>;R	<NRf>
R	<NRf>;L	<NRf>
R	<NRf>	
R	<NRf>:C	<NRf>
C	<NRf>;R	<NRf>
C	<NRf>	

Response for selected parameter:

R	<NRf>	for resistances in Ohms
C	<NRf>	for capacitances in Farads
L	<NRf>	for inductances in Henrys
Z	<NRf>	for impedances in Ohms
Q	<NR2>	for quality factor
D	<NR2>	for dissipation factor
P	<NR2>	for phase angle in degrees
V	<NRf>	for measured voltage in Volts
I	<NRf>	for measured current in Amperes

Exceeds a parameter of the component under test the measurement range, the response is OVER, or >, or <; for example:
C 22E-9;R OVER or Q>1000

PM6304 REMOTE CONTROL COMMANDS 3 – 17

Responses for COM?

Dominant ; secondary parameter in Auto mode in accordance with the Auto Mode Decision Diagram, Section 3.5.1.1.
If a certain parameter has been selected with the LOCK command, this parameter is shown at first, regardless of whether or not it is the dominant one.

L	<NRf>	
L	<NRf>;R	<NRf>
R	<NRf>;L	<NRf>
R	<NRf>	
R	<NRf>:C	<NRf>
C	<NRf>;R	<NRf>
C	<NRf>	

Response for selected parameter:

R	<NRf>	for resistances in Ohms
C	<NRf>	for capacitances in Farads
L	<NRf>	for inductances in Henrys
Z	<NRf>	for impedances in Ohms
Q	<NR2>	for quality factor
D	<NR2>	for dissipation factor
P	<NR2>	for phase angle in degrees
V	<NRf>	for measured voltage in Volts
I	<NRf>	for measured current in Amperes

Exceeds a parameter of the component under test the measurement range, the response is OVER, or >, or <; for example:
C 22E-9;R OVER or Q>1000

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

3.5.1.8 Store/Recall of Instrument Settings

Nine complete instrument settings including trim data can be stored in nonvolatile registers 1 to 9; the measured values are not stored. Already existing data will be overwritten. Register 0 contains the current instrument settings.

Commands: Common Commands in accordance with IEEE-488.2

★SAV <NR1>
★RCL <NR1>

3.5.2 Binning

Binning means sorting components into separate boxes or containers to get tighter tolerances or match like values.
During binning with the RCL Meter, single items of similar components are allocated to defined sorting fields based on their measured value. These fields are called bins.

3.5.2.1 Programming of Bin Tolerances

You can define ten different bins (bin 0 to 9). The instrument checks in the sequence bin 1, bin 2 ... to bin 9 and then bin 0. If the greatest tolerance is programmed for bin 1, then all components lying within this tolerance are immediately allocated to bin 1.

A different parameter can be defined for bin 0 than that for bin 1 to bin 9.

3 – 18 REMOTE CONTROL COMMANDS PM6304

3.5.1.8 Store/Recall of Instrument Settings

Nine complete instrument settings including trim data can be stored in nonvolatile registers 1 to 9; the measured values are not stored. Already existing data will be overwritten. Register 0 contains the current instrument settings.

Commands: Common Commands in accordance with IEEE-488.2

★SAV <NR1>
★RCL <NR1>

3.5.2 Binning

Binning means sorting components into separate boxes or containers to get tighter tolerances or match like values.
During binning with the RCL Meter, single items of similar components are allocated to defined sorting fields based on their measured value. These fields are called bins.

3.5.2.1 Programming of Bin Tolerances

You can define ten different bins (bin 0 to 9). The instrument checks in the sequence bin 1, bin 2 ... to bin 9 and then bin 0. If the greatest tolerance is programmed for bin 1, then all components lying within this tolerance are immediately allocated to bin 1.

A different parameter can be defined for bin 0 than that for bin 1 to bin 9.

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

For example, bins 1 to 9 can be used to check the tolerance of a capacitor while bin 0 checks its quality factor.

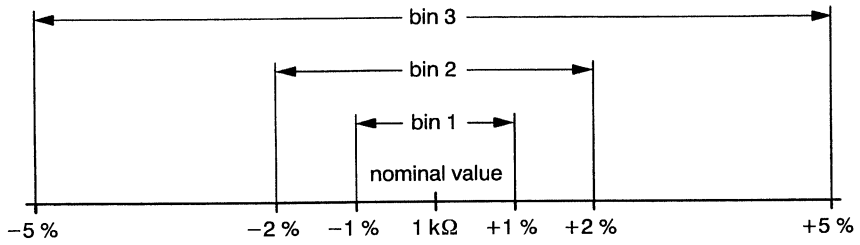
The test sequence for binning is as follows:

Component meets tolerance defined in:		
bin 1 to 9	bin 0	Display
YES	YES	bin 1 to 9
NO	do not care	FAIL
YES	NO	bin 0

In FAST measurement mode bin 0 is ignored.

The limits of the bins can be defined in several ways according to various application requirements:

- Binning components with certain value according to different tolerance class, e.g., for quality control or incoming inspection.



Nested limits with reference to a nominal value.

PM6304 REMOTE CONTROL COMMANDS 3 – 19

For example, bins 1 to 9 can be used to check the tolerance of a capacitor while bin 0 checks its quality factor.

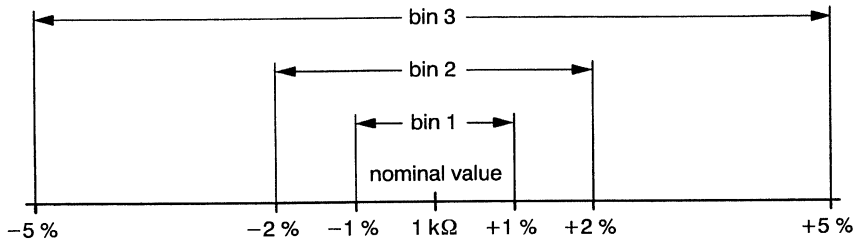
The test sequence for binning is as follows:

Component meets tolerance defined in:		
bin 1 to 9	bin 0	Display
YES	YES	bin 1 to 9
NO	do not care	FAIL
YES	NO	bin 0

In FAST measurement mode bin 0 is ignored.

The limits of the bins can be defined in several ways according to various application requirements:

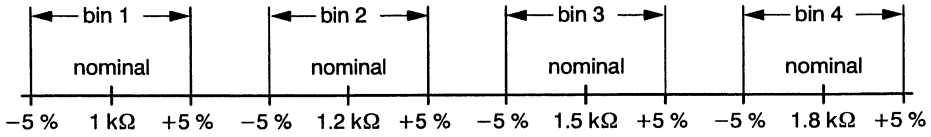
- Binning components with certain value according to different tolerance class, e.g., for quality control or incoming inspection.



Nested limits with reference to a nominal value.

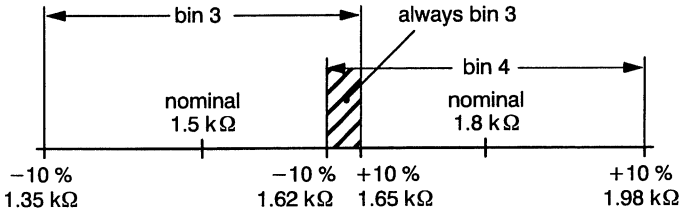
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- Binning components according to certain values, e.g. resistors according to the series E12, here with ±5 %.

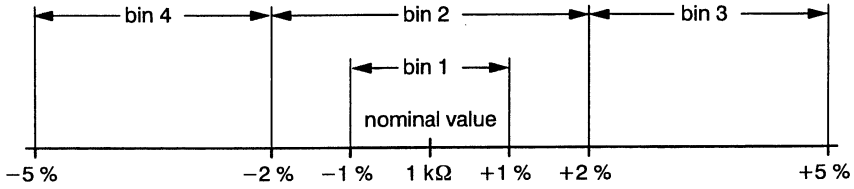


Sequential limits with reference to nominal values.

If limits overlap, a component lying within this overlapping area is always allocated to the bin with the lower number.



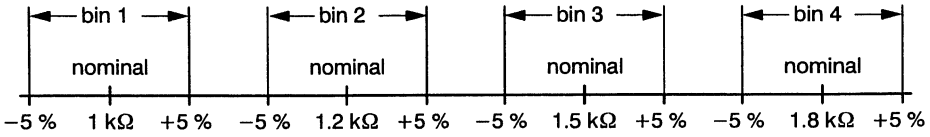
- Nested and sequential limits can be combined



Sequential and nested limits.

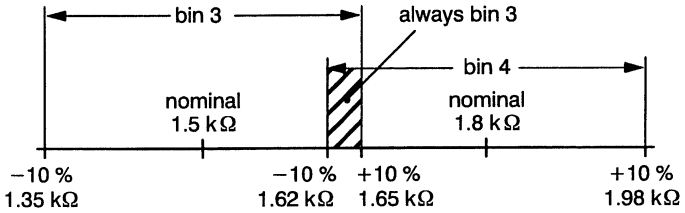
3 – 20 REMOTE CONTROL COMMANDS PM6304

- Binning components according to certain values, e.g. resistors according to the series E12, here with ±5 %.

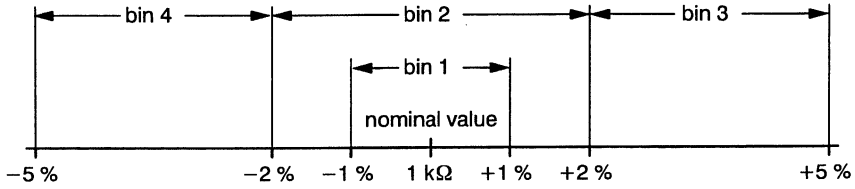


Sequential limits with reference to nominal values.

If limits overlap, a component lying within this overlapping area is always allocated to the bin with the lower number.



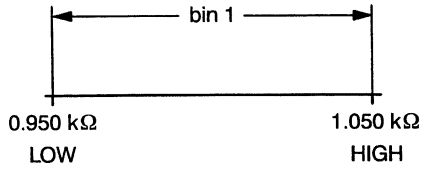
- Nested and sequential limits can be combined



Sequential and nested limits.

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

The limits can be programmed directly as absolute values instead of a nominal value with an upper and lower limit in percent.

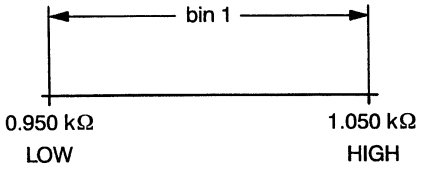


Commands:	**BIN**NING_**REL**ATIV	input with reference to a nominal value
	BINNING_**ABS**OLUT	input of absolute values
	LIMIT_**LO**W <NRf>	lower tolerance limit
	LIMIT_**HI**GH <NRf>	upper tolerance limit
	BIN <NR1>	defines the bin number which programmed values are valid for
	Parameter for bins:	
	RESISTANCE <NRf>	resistances in Ohms
	CAPACITANCE <NRf>	capacitances in Farads
	INDUCTANCE <NRf>	inductances in Henrys
	IMPEDANCE <NRf>	impedanze in Ohms
	QUALITY <NRf>	quality factor
	DISSIPATION <NRf>	dissipation factor
	PHASE <NRf>	phase angle in degrees

<NRf> is necessary only when you are programming nominal values and tolerances in percent. For input of absolute LOW and HIGH LIMIT values, skip <NRf>.

PM6304 REMOTE CONTROL COMMANDS 3 – 21

The limits can be programmed directly as absolute values instead of a nominal value with an upper and lower limit in percent.



Commands:	**BIN**NING_**REL**ATIV	input with reference to a nominal value
	BINNING_**ABS**OLUT	input of absolute values
	LIMIT_**LO**W <NRf>	lower tolerance limit
	LIMIT_**HI**GH <NRf>	upper tolerance limit
	BIN <NR1>	defines the bin number which programmed values are valid for
	Parameter for bins:	
	RESISTANCE <NRf>	resistances in Ohms
	CAPACITANCE <NRf>	capacitances in Farads
	INDUCTANCE <NRf>	inductances in Henrys
	IMPEDANCE <NRf>	impedanze in Ohms
	QUALITY <NRf>	quality factor
	DISSIPATION <NRf>	dissipation factor
	PHASE <NRf>	phase angle in degrees

<NRf> is necessary only when you are programming nominal values and tolerances in percent. For input of absolute LOW and HIGH LIMIT values, skip <NRf>.

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

Examples:

The following example shows a complete binning set for capacitors of 100 nF with tolerances of ±0.5 %, ±1 %, ±2 %, ±3 %, ±4 %, ±5 %, ±6 %, ±7 %, ±10 %, programmed with nominal value and tolerances in percent.
Bin 0 checks if the quality factor is within 300 to 600.

```
BIN_REL;CAP 100E-9; LIM_LO -.5;LIM_HI .5;BIN 1;
                    LIM_LO -1;LIM_HI 1;BIN 2;
                    LIM_LO -2;LIM_HI 2;BIN 3;
                    LIM_LO -3;LIM_HI 3;BIN 4;
                    LIM_LO -4;LIM_HI 4;BIN 5;
                    LIM_LO -5;LIM_HI 5;BIN 6;
                    LIM_LO -6;LIM_HI 6;BIN 7;
                    LIM_LO -7;LIM_HI 7;BIN 8;
                    LIM_LO -10;LIM_HI 10;BIN 9;
          QUAL 400;LIM_LO -25;LIM_HI +50;BIN 0 <LF>
```

Same values and tolerances are programmed with absolute values.

```
BIN_ABS;CAP;LIM_LO 99.5E-9;LIM_HI 100.5E-9;BIN 1;
           LIM_LO 99E-9;LIM_HI 101E-9;BIN 2;
           LIM_LO 98E-9;LIM_HI 102E-9;BIN 3;
           LIM_LO 97E-9;LIM_HI 103E-9;BIN 4;
           LIM_LO 96E-9;LIM_HI 104E-9;BIN 5;
           LIM_LO 95E-9;LIM_HI 105E-9;BIN 6;
           LIM_LO 94E-9;LIM_HI 106E-9;BIN 7;
           LIM_LO 93E-9;LIM_HI 107E-9;BIN 8;
           LIM_LO 90E-9;LIM_HI 110E-9;BIN 9;
BIN_ABS;QUAL;LIM_LO 300;LIM_HI 600;BIN 0; <LF>
```

3 – 22 REMOTE CONTROL COMMANDS PM6304

Examples:

The following example shows a complete binning set for capacitors of 100 nF with tolerances of ±0.5 %, ±1 %, ±2 %, ±3 %, ±4 %, ±5 %, ±6 %, ±7 %, ±10 %, programmed with nominal value and tolerances in percent.
Bin 0 checks if the quality factor is within 300 to 600.

BIN_REL;CAP 100E-9; LIM_LO -.5;LIM_HI .5;BIN 1;
LIM_LO -1;LIM_HI 1;BIN 2;
LIM_LO -2;LIM_HI 2;BIN 3;
LIM_LO -3;LIM_HI 3;BIN 4;
LIM_LO -4;LIM_HI 4;BIN 5;
LIM_LO -5;LIM_HI 5;BIN 6;
LIM_LO -6;LIM_HI 6;BIN 7;
LIM_LO -7;LIM_HI 7;BIN 8;
LIM_LO -10;LIM_HI 10;BIN 9;
QUAL 400;LIM_LO -25;LIM_HI +50;BIN 0 <LF>

Same values and tolerances are programmed with absolute values.

BIN_ABS;CAP;LIM_LO 99.5E-9;LIM_HI 100.5E-9;BIN 1;
LIM_LO 99E-9;LIM_HI 101E-9;BIN 2;
LIM_LO 98E-9;LIM_HI 102E-9;BIN 3;
LIM_LO 97E-9;LIM_HI 103E-9;BIN 4;
LIM_LO 96E-9;LIM_HI 104E-9;BIN 5;
LIM_LO 95E-9;LIM_HI 105E-9;BIN 6;
LIM_LO 94E-9;LIM_HI 106E-9;BIN 7;
LIM_LO 93E-9;LIM_HI 107E-9;BIN 8;
LIM_LO 90E-9;LIM_HI 110E-9;BIN 9;
BIN_ABS;QUAL;LIM_LO 300;LIM_HI 600;BIN 0; <LF>

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

3.5.2.2 Store/Recall of Bin Sets

Nine complete bin records (bins 0 to 9), including selected instrument settings can be stored into registers 1 to 9 of the instrument. Storage register 0 contains the bin set for current binning. These registers are independent of those mentioned in Section 3.5.1.8.

Commands:	**BIN**NING_**STO**RE <NR1>	stores binning set into selected register (1 to 9)
	BUFFER_**REC**ALL <NR1>	loads binning set from selected register into a buffer for editing
	BINNING_**REC**ALL <NR1>	transfers binning set from selected register into register 0 for binning
	BUFFER_**CL**EA**R**	deletes buffer for editing
	BINNING_**ERA**SE <NR1>	deletes binning set of selected register
Query:	**BIN**NING_**SET?** <NR1>	asks for the complete bin set of selected register

Response:
```
BIN_REL;RESI 1E3;LIM_LO -5;LIM_HI 5;BIN 1;
                 LIM_LO -10;LIM_HI 10;BIN 2;
                 LIM_LO -15;LIM_HI 15;BIN 3;
                 LIM_LO .....
```

Query:	**BUF**FER_**BIN?** <NR1>	asks for the selected bin in the buffer for editing

Response: e.g. LIM_LO -10;LIM_HI 10; BIN 2

PM6304 REMOTE CONTROL COMMANDS 3 – 23

3.5.2.2 Store/Recall of Bin Sets

Nine complete bin records (bins 0 to 9), including selected instrument settings can be stored into registers 1 to 9 of the instrument. Storage register 0 contains the bin set for current binning. These registers are independent of those mentioned in Section 3.5.1.8.

Commands:	**BIN**NING_**STO**RE <NR1>	stores binning set into selected register (1 to 9)
	BUFFER_**REC**ALL <NR1>	loads binning set from selected register into a buffer for editing
	BINNING_**REC**ALL <NR1>	transfers binning set from selected register into register 0 for binning
	BUFFER_**CL**EA**R**	deletes buffer for editing
	BINNING_**ERA**SE <NR1>	deletes binning set of selected register
Query:	**BIN**NING_**SET?** <NR1>	asks for the complete bin set of selected register

Response:
```
BIN_REL;RESI 1E3;LIM_LO -5;LIM_HI 5;BIN 1;
                 LIM_LO -10;LIM_HI 10;BIN 2;
                 LIM_LO -15;LIM_HI 15;BIN 3;
                 LIM_LO .....
```

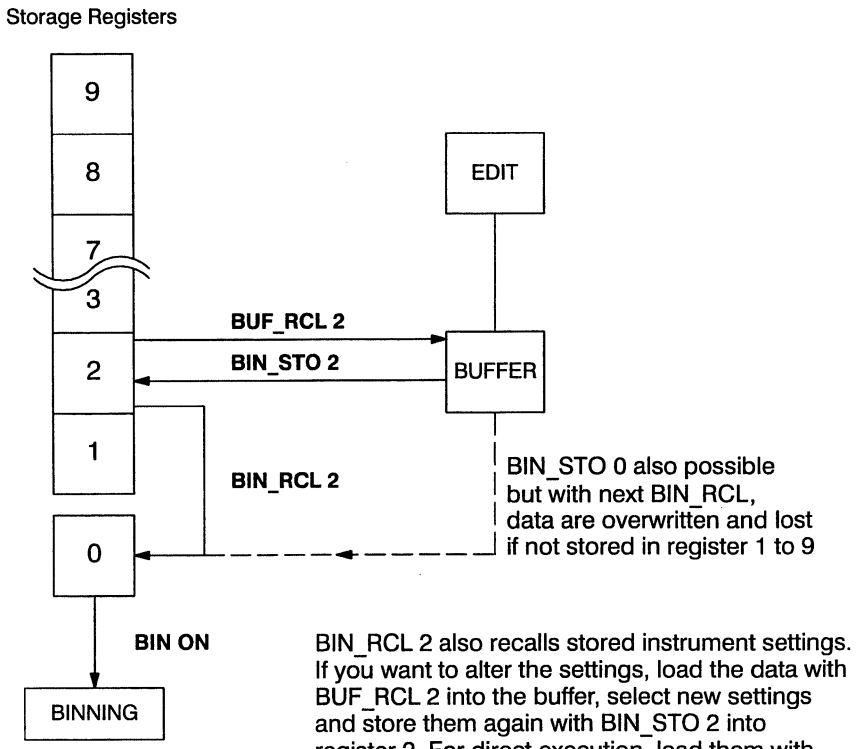
Query:	**BUF**FER_**BIN?** <NR1>	asks for the selected bin in the buffer for editing

Response: e.g. LIM_LO -10;LIM_HI 10; BIN 2

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

3.5.2.3 Operation Mode Binning

Select desired bin set and transfer it into register 0 for binning.
If you do not need all the bins for sorting, you can disable bins not needed, except bin 1. To do this, load the set into the buffer for editing, disable the bins, and load the set into register 0.



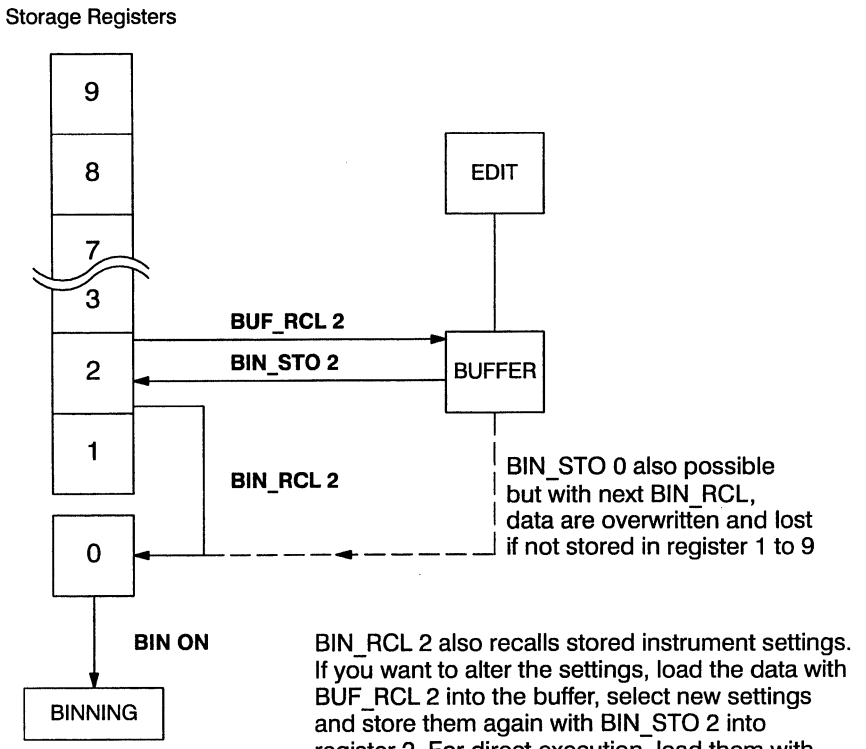
Commands: **BIN**NING **ON**
BINNING **OFF**

BIN_DISABLE <NR1>
BIN_ENABLE <NR1>

3 – 24 REMOTE CONTROL COMMANDS PM6304

3.5.2.3 Operation Mode Binning

Select desired bin set and transfer it into register 0 for binning.
If you do not need all the bins for sorting, you can disable bins not needed, except bin 1. To do this, load the set into the buffer for editing, disable the bins, and load the set into register 0.



Commands: **BIN**NING **ON**
BINNING **OFF**

BIN_DISABLE <NR1>
BIN_ENABLE <NR1>

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

When you select binning mode, the instrument is set to single measurement mode.

Insert the component to be measured and start the measurement.

The display shows the bin number the component is allocated to or FAIL (see table in Section 3.5.2.1).
This information can also be asked by the controller.

Commands: **TRIG**

Query: **BIN?** or **COMP?**

Response: BIN <NR1> or BIN FAIL respectively
R <NR3>; BIN <NR1> or BIN FAIL

3.5.3 Additional Commands

Average

During continuous measurements, the instrument performs an exponential average from the individual measurements before the value is shown in the display. The time factor of the averaging can be increased to reduce any fluctuations in the display.

Commands: **AV**ERAGE **ON**
AVERAGE **OFF**

Query: **AV**ERAGE**?**

Response: AVG ON
AVG OFF

PM6304 REMOTE CONTROL COMMANDS 3 – 25

When you select binning mode, the instrument is set to single measurement mode.

Insert the component to be measured and start the measurement.

The display shows the bin number the component is allocated to or FAIL (see table in Section 3.5.2.1).
This information can also be asked by the controller.

Commands: **TRIG**

Query: **BIN?** or **COMP?**

Response: BIN <NR1> or BIN FAIL respectively
R <NR3>; BIN <NR1> or BIN FAIL

3.5.3 Additional Commands

Average

During continuous measurements, the instrument performs an exponential average from the individual measurements before the value is shown in the display. The time factor of the averaging can be increased to reduce any fluctuations in the display.

Commands: **AV**ERAGE **ON**
AVERAGE **OFF**

Query: **AV**ERAGE**?**

Response: AVG ON
AVG OFF

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

Range Hold

When you measure components the instrument checks voltage and current and internally selects an appropriate gain factor. If you measure similar components with slightly different values, perform one measurement and set the instrument to Range Hold. This prevents the instrument from setting a new gain factor for each component.

Range Hold increases the measurement speed because the instrument no longer needs to check current and voltage for selecting the gain factor. Range Hold is particularly valuable in the Fast Measurement Mode (Section 3.5.1.6).

Commands: **RANGE_HOLD ON**
RANGE_HOLD OFF

Query: **RANGE_HOLD?**

Response: RNG_HOLD ON
RNG_HOLD OFF

RANGE_HOLD ON is applicable only in SINGLE mode.
After receiving one of the following commands, the instrument automatically returns to Range Hold OFF:
TRIM, BIN ON, BIN OFF, BIN_RCL <NR1>, ★RCL, TEST_SIG DC, TEST_SIG AC, LEV HI, LEV NO, LEV LO, or FRE <NRf>.

LOCK Function

When the instrument measures components with a quality factor of about Q = 1 either a resistance or a capacitance, respectively a resistance or an inductance is determined as the dominant parameter, see Auto Mode Decision Diagram, Section 3.5.1.1. With the LOCK function you can define which parameter shall be displayed as the dominant parameter.

3 – 26 REMOTE CONTROL COMMANDS PM6304

Range Hold

When you measure components the instrument checks voltage and current and internally selects an appropriate gain factor. If you measure similar components with slightly different values, perform one measurement and set the instrument to Range Hold. This prevents the instrument from setting a new gain factor for each component.

Range Hold increases the measurement speed because the instrument no longer needs to check current and voltage for selecting the gain factor. Range Hold is particularly valuable in the Fast Measurement Mode (Section 3.5.1.6).

Commands: RANGE_HOLD ON
RANGE_HOLD OFF

Query: RANGE_HOLD?

Response: RNG_HOLD ON
RNG_HOLD OFF

RANGE_HOLD ON is applicable only in SINGLE mode.
After receiving one of the following commands, the instrument automatically returns to Range Hold OFF:
TRIM, BIN ON, BIN OFF, BIN_RCL <NR1>, ★RCL, TEST_SIG DC, TEST_SIG AC, LEV HI, LEV NO, LEV LO, or FRE <NRf>.

LOCK Function

When the instrument measures components with a quality factor of about Q = 1 either a resistance or a capacitance, respectively a resistance or an inductance is determined as the dominant parameter, see Auto Mode Decision Diagram, Section 3.5.1.1. With the LOCK function you can define which parameter shall be displayed as the dominant parameter.

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

The function is applicable for the modes AUTO, SER, PAR, and FAST. It cannot be stored with *SAV into the internal memory registers. The instrument returns to LOCK OFF when different setting are called up or when the instrument is turned off.

Commands:	**LOCK R**	sets resistance as dominant parameter
	LOCK C	sets capacitance as dominant parameter
	LOCK L	sets inductance as dominant parameter
	LOCK OFF	switches the LOCK function off
Query:	**LOCK?**	
Response:	LOCK R	
	LOCK C	
	LOCK L	
	LOCK OFF	

Calibration

The instrument was calibrated in the factory prior to shipment.
The calibrating data are stored in an EEPROM and are referenced for each measurement.

It is necessary to calibrate again after loss of data (replacing the EEPROM), after changing components during repair which influence the measuring results, or when the instrument does not meet the technical specifications.

In normal operation recalibration once a year is sufficient.
Details on calibration can be found in the SERVICE MANUAL.

Query: **CAL**IBRATE**?**

Response: CAL OFF (means calibration data not valid or lost)
CAL ON; NO.<NR1>,YY/MM/DD

<NR1> = number of calibrations since first delivery
YY/MM/DD = Year/Month/DAY
is the date of last calibration via interface

PM6304 REMOTE CONTROL COMMANDS 3 – 27

The function is applicable for the modes AUTO, SER, PAR, and FAST. It cannot be stored with *SAV into the internal memory registers. The instrument returns to LOCK OFF when different setting are called up or when the instrument is turned off.

Commands: **LOCK R** sets resistance as dominant parameter
LOCK C sets capacitance as dominant parameter
LOCK L sets inductance as dominant parameter
LOCK OFF switches the LOCK function off

Query: **LOCK?**

Response: LOCK R
LOCK C
LOCK L
LOCK OFF

Calibration

The instrument was calibrated in the factory prior to shipment.
The calibrating data are stored in an EEPROM and are referenced for each measurement.

It is necessary to calibrate again after loss of data (replacing the EEPROM), after changing components during repair which influence the measuring results, or when the instrument does not meet the technical specifications.

In normal operation recalibration once a year is sufficient.
Details on calibration can be found in the SERVICE MANUAL.

Query: **CAL**IBRATE**?**

Response: CAL OFF (means calibration data not valid or lost)
CAL ON; NO.<NR1>,YY/MM/DD

<NR1> = number of calibrations since first delivery
YY/MM/DD = Year/Month/DAY
is the date of last calibration via interface

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

PROGRAMMING EXAMPLES

Chapter 4

PROGRAMMING EXAMPLES

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 PROGRAMMING EXAMPLES

4.1 IEEE-488 INTERFACE

The following examples are related to an IBM-compatible PC. The first one uses a built-in IEEE-488 interface, the second one uses the standard serial port of the controller and the RS-232 interface. You should have a basic knowledge of the MS-DOS operating system of the controller and the programming language QuickBasic (version 4.0 and above) to understand the examples that follow.
The program allows you to input commands via the controller keyboard and to send them to the RCL meter via the interface.

```
DECLARE SUB SendCmd (WR$)
DECLARE SUB SendStr (WR$)
DECLARE SUB ErrChk (Cs!, Sts%)
REM $INCLUDE: 'qbdecl4.bas'

    CLS
    PRINT " "
    PRINT " "
    PRINT "                 ***** DEMO PROGRAM FOR PM6304 *****"
    PRINT
    PRINT "                       PRESS 'RETURN' TO CONTINUE  "
    PRINT
    PRINT "               To leave running program type 'END' or 'end' "
    BEEP
    PRINT
    B$ = ""
    DO                                  'waiting for 'RETURN'
        B$ = INKEY$
    LOOP UNTIL B$ = CHR$(13)

    CLS                                 'clears screen
    Stp = 0
    BDNAME$ = "RCL1"                    'name of the device on the conf.table
    CALL IBFIND(BDNAME$, RCL%)          'open device
    CALL ErrChk(1, RCL%)                'check error

    IF Stp = 0 THEN
        CALL IBCLR(RCL%)                'send interface clear
        CALL ErrChk(2, IBSTA%)          'check error
    END IF

    IF Stp = 0 THEN
        A$ = "*ese 255"                     'initialize ESR register
        CALL SendCmd(A$)                    'send command

        A$ = "*cls"                         'clear status register
        CALL SendCmd(A$)                    'send command

        A$ = "*IDN?"                        'ask for identiti
        CALL SendStr(A$)                    'send command string
```

PM6304 PROGRAMMING EXAMPLES FOR IEEE−488 and RS−232 4 − 1

4 PROGRAMMING EXAMPLES

4.1 IEEE-488 INTERFACE

The following examples are related to an IBM-compatible PC. The first one uses a built-in IEEE-488 interface, the second one uses the standard serial port of the controller and the RS-232 interface. You should have a basic knowledge of the MS-DOS operating system of the controller and the programming language QuickBasic (version 4.0 and above) to understand the examples that follow.
The program allows you to input commands via the controller keyboard and to send them to the RCL meter via the interface.

```
DECLARE SUB SendCmd (WR$)
DECLARE SUB SendStr (WR$)
DECLARE SUB ErrChk (Cs!, Sts%)
REM $INCLUDE: 'qbdecl4.bas'

    CLS
    PRINT " "
    PRINT " "
    PRINT "                 ***** DEMO PROGRAM FOR PM6304 *****"
    PRINT
    PRINT "                       PRESS 'RETURN' TO CONTINUE  "
    PRINT
    PRINT "               To leave running program type 'END' or 'end' "
    BEEP
    PRINT
    B$ = ""
    DO                                  'waiting for 'RETURN'
        B$ = INKEY$
    LOOP UNTIL B$ = CHR$(13)

    CLS                                 'clears screen
    Stp = 0
    BDNAME$ = "RCL1"                    'name of the device on the conf.table
    CALL IBFIND(BDNAME$, RCL%)          'open device
    CALL ErrChk(1, RCL%)                'check error

    IF Stp = 0 THEN
        CALL IBCLR(RCL%)                'send interface clear
        CALL ErrChk(2, IBSTA%)          'check error
    END IF

    IF Stp = 0 THEN
        A$ = "*ese 255"                     'initialize ESR register
        CALL SendCmd(A$)                    'send command

        A$ = "*cls"                         'clear status register
        CALL SendCmd(A$)                    'send command

        A$ = "*IDN?"                        'ask for identiti
        CALL SendStr(A$)                    'send command string
```

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

```
        WHILE Stp = 0
             INPUT "COMMAND :     ", A$    'reading keyboard input
             IF A$ = "END" OR A$ = "end" THEN
                  CALL IBLOC(RCL%)          'set instrument to 'LOCAL'
                  CLS                       'clear screen
                  Stp = 1
             ELSE
                  CALL SendStr(A$)          'send command string
             END IF
             PRINT
             PRINT
        WEND
    END IF
END

SUB ErrChk (Cs, Sts%)                  'Error handler
    SHARED Stp
    SELECT CASE Cs
        CASE 1
            IF Sts% < 0 THEN
                PRINT
                PRINT
                PRINT "IBFIND ERROR"
                PRINT "Check the configuration of the bus interface with IBCONF.EXE"
                PRINT
                Stp = 1                 'terminate program
            END IF
        CASE 2
            IF Sts% < 0 THEN
                PRINT
                PRINT
                PRINT "     BUS ERROR!"
                PRINT
                PRINT "     Please check connections and start program again"
                PRINT
                Stp = 1                 'terminate the program
            END IF
        CASE 3
            IF Sts% < 0 THEN
                PRINT
                PRINT
                PRINT "GPIB ERROR"
                PRINT
            END IF
            IF Sts% > 16383 THEN
                PRINT
                PRINT
                PRINT "TIME OUT ERROR"
                PRINT
            END IF
    END SELECT
END SUB
```

4 – 2 PROGRAMMING EXAMPLES FOR IEEE–488 and RS–232 PM6304


```
        WHILE Stp = 0
             INPUT "COMMAND :     ", A$    'reading keyboard input
             IF A$ = "END" OR A$ = "end" THEN
                  CALL IBLOC(RCL%)          'set instrument to 'LOCAL'
                  CLS                       'clear screen
                  Stp = 1
             ELSE
                  CALL SendStr(A$)          'send command string
             END IF
             PRINT
             PRINT
        WEND
    END IF
END

SUB ErrChk (Cs, Sts%)                  'Error handler
    SHARED Stp
    SELECT CASE Cs
        CASE 1
            IF Sts% < 0 THEN
                PRINT
                PRINT
                PRINT "IBFIND ERROR"
                PRINT "Check the configuration of the bus interface with IBCONF.EXE"
                PRINT
                Stp = 1                 'terminate program
            END IF
        CASE 2
            IF Sts% < 0 THEN
                PRINT
                PRINT
                PRINT "     BUS ERROR!"
                PRINT
                PRINT "     Please check connections and start program again"
                PRINT
                Stp = 1                 'terminate the program
            END IF
        CASE 3
            IF Sts% < 0 THEN
                PRINT
                PRINT
                PRINT "GPIB ERROR"
                PRINT
            END IF
            IF Sts% > 16383 THEN
                PRINT
                PRINT
                PRINT "TIME OUT ERROR"
                PRINT
            END IF
    END SELECT
END SUB
```


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

```
SUB SendCmd (WR$)
    'Send command string to instrument via GPIB without response
    SHARED RCL%
    CALL IBWRT(RCL%, WR$)              'output command string
    CALL ErrChk(3, IBSTA%)             'check error
END SUB

SUB SendStr (WR$)
    'Send command string to instrument via GPIB with response
    SHARED RCL%
    qry = 0                            'query flag
    qer = 0                            'error query flag
    CALL IBWRT(RCL%, WR$)              'output command string

    IF IBSTA% < 0 THEN
        CALL ErrChk(3, IBSTA%)         'check error
    ELSE
        Stat = 0
        CALL IBRSP(RCL%, Stat%)        'get status byte from instrument
        CALL ErrChk(3, IBSTA%)         'check error
        IF (Stat% AND 16) THEN         'checks whether MAV is set
              qry = 1
        END IF
        IF (Stat% AND 32) THEN         'checks whether ESB is set
              BEEP
              WR$ = "err?"             'error query
              CALL IBWRT(RCL%, WR$)    'output command string
              qry = 1
              qer = 1
        END IF
    END IF

    IF INSTR(WR$, "?") > 0 OR qry = 1 THEN 'check if query command
        MaxLen = 164                   'max. length of response string
        RD$ = SPACE$(MaxLen)           'clear response string
        CALL IBRD(RCL%, RD$)           'get response string
        IF IBSTA% < 0 THEN
            CALL ErrChk(3, IBSTA%)     'check error
        ELSE
            PRINT
            PRINT "RESPONSE :    " + RD$  'response string
            IF qer = 1 THEN
                WR$ = "*cls"           'clear status register
                CALL IBWRT(RCL%, WR$)  'output command string
            END IF
        END IF
    END IF
END SUB
```

PM6304 PROGRAMMING EXAMPLES FOR IEEE−488 and RS−232 4 − 3


```
SUB SendCmd (WR$)
    'Send command string to instrument via GPIB without response
    SHARED RCL%
    CALL IBWRT(RCL%, WR$)              'output command string
    CALL ErrChk(3, IBSTA%)             'check error
END SUB

SUB SendStr (WR$)
    'Send command string to instrument via GPIB with response
    SHARED RCL%
    qry = 0                            'query flag
    qer = 0                            'error query flag
    CALL IBWRT(RCL%, WR$)              'output command string

    IF IBSTA% < 0 THEN
        CALL ErrChk(3, IBSTA%)         'check error
    ELSE
        Stat = 0
        CALL IBRSP(RCL%, Stat%)        'get status byte from instrument
        CALL ErrChk(3, IBSTA%)         'check error
        IF (Stat% AND 16) THEN         'checks whether MAV is set
              qry = 1
        END IF
        IF (Stat% AND 32) THEN         'checks whether ESB is set
              BEEP
              WR$ = "err?"             'error query
              CALL IBWRT(RCL%, WR$)    'output command string
              qry = 1
              qer = 1
        END IF
    END IF

    IF INSTR(WR$, "?") > 0 OR qry = 1 THEN 'check if query command
        MaxLen = 164                   'max. length of response string
        RD$ = SPACE$(MaxLen)           'clear response string
        CALL IBRD(RCL%, RD$)           'get response string
        IF IBSTA% < 0 THEN
            CALL ErrChk(3, IBSTA%)     'check error
        ELSE
            PRINT
            PRINT "RESPONSE :    " + RD$  'response string
            IF qer = 1 THEN
                WR$ = "*cls"           'clear status register
                CALL IBWRT(RCL%, WR$)  'output command string
            END IF
        END IF
    END IF
END SUB
```


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

4.2 RS-232 INTERFACE

```
DECLARE SUB SndCmd (WR$)
DECLARE SUB SndMsg (WR$)
DECLARE FUNCTION ChkCmd$ (WR$)
DECLARE SUB ClrBuf (COMFILE)
DECLARE FUNCTION IniPrg (COMFILE)
DECLARE FUNCTION RecMsg$ (COMFILE)
DECLARE SUB SetDTR (Cnt)

COMMON SHARED COMFILE, MCREG, Chk
    COMFILE = 1                                 'file buffer handle
    MCREG = IniPrg(COMFILE)                     'inilize program
    Stp = 0
    WHILE (Stp = 0)
       SEND$ = CHR$(27) + "2"
       CALL SndCmd(SEND$)                       'send goto remote
       SEND$ = "*cls;*ese 255"
       CALL SndCmd(SEND$)                       'send status clear
       SEND$ = "*idn?"
       CALL SndCmd(SEND$)                       'send identifikation query
       REC$ = RecMsg$(COMFILE)                  'get identifikation
       IF LEN(REC$) = 0 THEN                    'if buffer empty
          PRINT
          PRINT "No answer! Please check the connection and setting!"
          CLOSE COMFILE
          Stp = 1
       ELSE
          CLS
          PRINT "connected instrument : "; REC$    'display identity string
          PRINT
       END IF
       '
       '****** main loop *********************************************
       WHILE (Stp = 0)
          PRINT
          PRINT
          LINE INPUT "COMMAND : "; SEND$        'command input
          SEND$ = ChkCmd(SEND$)                 'checks the command
          IF Chk = 0 THEN
             SEND$ = CHR$(27) + "1"
             CALL SndCmd(SEND$)                 'sets instrument to local
             CLOSE COMFILE
             Stp = 1
             CLS
          ELSE
             CALL SndMsg(SEND$)                 'send message
          END IF
       WEND
    WEND
END
```

4 – 4 PROGRAMMING EXAMPLES FOR IEEE–488 and RS–232 PM6304

4.2 RS-232 INTERFACE

```
DECLARE SUB SndCmd (WR$)
DECLARE SUB SndMsg (WR$)
DECLARE FUNCTION ChkCmd$ (WR$)
DECLARE SUB ClrBuf (COMFILE)
DECLARE FUNCTION IniPrg (COMFILE)
DECLARE FUNCTION RecMsg$ (COMFILE)
DECLARE SUB SetDTR (Cnt)

COMMON SHARED COMFILE, MCREG, Chk
    COMFILE = 1                                 'file buffer handle
    MCREG = IniPrg(COMFILE)                     'inilize program
    Stp = 0
    WHILE (Stp = 0)
       SEND$ = CHR$(27) + "2"
       CALL SndCmd(SEND$)                       'send goto remote
       SEND$ = "*cls;*ese 255"
       CALL SndCmd(SEND$)                       'send status clear
       SEND$ = "*idn?"
       CALL SndCmd(SEND$)                       'send identifikation query
       REC$ = RecMsg$(COMFILE)                  'get identifikation
       IF LEN(REC$) = 0 THEN                    'if buffer empty
          PRINT
          PRINT "No answer! Please check the connection and setting!"
          CLOSE COMFILE
          Stp = 1
       ELSE
          CLS
          PRINT "connected instrument : "; REC$    'display identity string
          PRINT
       END IF
       '
       '****** main loop *********************************************
       WHILE (Stp = 0)
          PRINT
          PRINT
          LINE INPUT "COMMAND : "; SEND$        'command input
          SEND$ = ChkCmd(SEND$)                 'checks the command
          IF Chk = 0 THEN
             SEND$ = CHR$(27) + "1"
             CALL SndCmd(SEND$)                 'sets instrument to local
             CLOSE COMFILE
             Stp = 1
             CLS
          ELSE
             CALL SndMsg(SEND$)                 'send message
          END IF
       WEND
    WEND
END
```

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

```
FUNCTION ChkCmd$ (WR$)
    '****** command check ****************************************
     Chk = 2
     IF LEN(WR$) = 3 THEN
        IF WR$ = "END" OR WR$ = "end" THEN Chk = 0
        IF WR$ = "GTL" OR WR$ = "gtl" THEN WR$ = CHR$(27) + "1"
        IF WR$ = "GTR" OR WR$ = "gtr" THEN WR$ = CHR$(27) + "2"
        IF WR$ = "DCL" OR WR$ = "dcl" THEN WR$ = CHR$(27) + "4"
        IF WR$ = "LLO" OR WR$ = "llo" THEN WR$ = CHR$(27) + "5"
        IF WR$ = "dtr" OR WR$ = "DTR" THEN WR$ = CHR$(27) + "8"
        IF WR$ = "STB" OR WR$ = "stb" THEN
           WR$ = CHR$(27) + "7"
           Chk = 3
        END IF
     ELSE                                        'no special command
        Chk = 1
        WR$ = WR$ + CHR$(10)                     'append terminator
     END IF
     ChkCmd$ = WR$
END FUNCTION

SUB ClrBuf (COMFILE)
     '******** clear buffer ***************************************
     CALL SetDTR(1)                              'set DTR on
     WHILE (LOC(COMFILE) > 0)                    'if buffer not empty
        C$ = INPUT$(1, #COMFILE)                 'read one character
        CALL SetDTR(1)                           'set DTR on again
     WEND                                        'next character
END SUB

FUNCTION IniPrg (COMFILE)
    CLS
    PRINT "       ***************************************************************"
    PRINT "       *********    Demonstration program for PM6304   ***************"
    PRINT "       *********      with RS-232 interface            ***************"
    PRINT "       ***************************************************************"
    PRINT
    PRINT
    PRINT
    '****** list of special commands ***************************************
    PRINT "Special commands : "
    PRINT
    PRINT "          GTL  : go to local"
    PRINT "          GTR  : go to remote"
    PRINT "          DCL  : device clear"
    PRINT "          LLO  : local lock out"
    PRINT "          STB  : get status byte"
    PRINT "          DTR  : device trigger"
    PRINT
    PRINT
    PRINT "To leave running programm type 'END' "
    PRINT
    PRINT
    PRINT "                          press a key to continue ";
    C$ = ""
    WHILE (C$ = "")
       C$ = INKEY$
    WEND
    CLS
```

PM6304 PROGRAMMING EXAMPLES FOR IEEE−488 and RS−232 4 − 5


```
FUNCTION ChkCmd$ (WR$)
    '****** command check ****************************************
     Chk = 2
     IF LEN(WR$) = 3 THEN
        IF WR$ = "END" OR WR$ = "end" THEN Chk = 0
        IF WR$ = "GTL" OR WR$ = "gtl" THEN WR$ = CHR$(27) + "1"
        IF WR$ = "GTR" OR WR$ = "gtr" THEN WR$ = CHR$(27) + "2"
        IF WR$ = "DCL" OR WR$ = "dcl" THEN WR$ = CHR$(27) + "4"
        IF WR$ = "LLO" OR WR$ = "llo" THEN WR$ = CHR$(27) + "5"
        IF WR$ = "dtr" OR WR$ = "DTR" THEN WR$ = CHR$(27) + "8"
        IF WR$ = "STB" OR WR$ = "stb" THEN
           WR$ = CHR$(27) + "7"
           Chk = 3
        END IF
     ELSE                                        'no special command
        Chk = 1
        WR$ = WR$ + CHR$(10)                     'append terminator
     END IF
     ChkCmd$ = WR$
END FUNCTION

SUB ClrBuf (COMFILE)
     '******** clear buffer ***************************************
     CALL SetDTR(1)                              'set DTR on
     WHILE (LOC(COMFILE) > 0)                    'if buffer not empty
        C$ = INPUT$(1, #COMFILE)                 'read one character
        CALL SetDTR(1)                           'set DTR on again
     WEND                                        'next character
END SUB

FUNCTION IniPrg (COMFILE)
    CLS
    PRINT "       ***************************************************************"
    PRINT "       *********    Demonstration program for PM6304   ***************"
    PRINT "       *********      with RS-232 interface            ***************"
    PRINT "       ***************************************************************"
    PRINT
    PRINT
    PRINT
    '****** list of special commands ***************************************
    PRINT "Special commands : "
    PRINT
    PRINT "          GTL  : go to local"
    PRINT "          GTR  : go to remote"
    PRINT "          DCL  : device clear"
    PRINT "          LLO  : local lock out"
    PRINT "          STB  : get status byte"
    PRINT "          DTR  : device trigger"
    PRINT
    PRINT
    PRINT "To leave running programm type 'END' "
    PRINT
    PRINT
    PRINT "                          press a key to continue ";
    C$ = ""
    WHILE (C$ = "")
       C$ = INKEY$
    WEND
    CLS
```


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

```
    PRINT
    '****** Enviroment : IBM AT or Compatible  *********
    '****** Initialisation of PM6304 / serial interface *********************
    PRINT "         Please set the RS-232 interface parameters of the PM6304 to : "
    PRINT "                 Mode      : COmmunication "
    PRINT "                 Baudrate  : 9600"
    PRINT "                 Parity    : off"
    PRINT "                 Data      : 8"
    PRINT "                 Handshake : on"
    PRINT "                 Wire      : 7"
    PRINT
    PRINT
    '
    '****** Initialisation of PC communication port ***************
     PRINT "       Which communication port of the PC do you use ?"
     PRINT
     PRINT "                 COM1   [1]"
     PRINT "                 COM2   [2]                              please select "
     PRINT
     PORT = 0
     WHILE (PORT = 0)
        C$ = INKEY$                         'get key code
        IF C$ = "1" THEN PORT = 1
        IF C$ = "2" THEN PORT = 2
     WEND
     MCREG = &H3FC
     IF PORT = 2 THEN MCREG = &H2FC      'modem control register address
     SER$ = "COM" + CHR$(48 + PORT) + ":9600,N,8,1,CS,DS,CD,RS"
     OPEN SER$ FOR RANDOM AS #COMFILE
     WIDTH #COMFILE, 255
     CALL ClrBuf(COMFILE)                'clear input buffer
     IniPrg = MCREG
END FUNCTION

FUNCTION RecMsg$ (COMFILE)
   '******** receive message from instrument ******************
   Del = 1                                  'communication delay
   REC$ = ""                                'clear response string
   DO
      TR! = TIMER                            'start timeout timer
      DO
         IF TIMER < TR! THEN TR! = TR! - 86400!     'adjust 24.00h
      LOOP UNTIL (LOC(COMFILE) > 0) OR (TIMER - TR! > Del)

      IF LOC(COMFILE) = 0 THEN               'if there no characters
         PRINT "**** receive timeout ****"
         Stp = 1
      ELSE
         C$ = INPUT$(1, #COMFILE)             'read one character
         CALL SetDTR(1)                       'set DTR on
         IF NOT C$ = CHR$(10) THEN
            REC$ = REC$ + C$                  'append character
         END IF
      END IF
   LOOP UNTIL ((C$ = CHR$(10)) OR (Stp = 1))
   RecMsg$ = REC$
END FUNCTION
```

4 – 6 PROGRAMMING EXAMPLES FOR IEEE–488 and RS–232 PM6304


```
    PRINT
    '****** Enviroment : IBM AT or Compatible  *********
    '****** Initialisation of PM6304 / serial interface *********************
    PRINT "         Please set the RS-232 interface parameters of the PM6304 to : "
    PRINT "                 Mode      : COmmunication "
    PRINT "                 Baudrate  : 9600"
    PRINT "                 Parity    : off"
    PRINT "                 Data      : 8"
    PRINT "                 Handshake : on"
    PRINT "                 Wire      : 7"
    PRINT
    PRINT
    '
    '****** Initialisation of PC communication port ***************
     PRINT "       Which communication port of the PC do you use ?"
     PRINT
     PRINT "                 COM1   [1]"
     PRINT "                 COM2   [2]                              please select "
     PRINT
     PORT = 0
     WHILE (PORT = 0)
        C$ = INKEY$                         'get key code
        IF C$ = "1" THEN PORT = 1
        IF C$ = "2" THEN PORT = 2
     WEND
     MCREG = &H3FC
     IF PORT = 2 THEN MCREG = &H2FC      'modem control register address
     SER$ = "COM" + CHR$(48 + PORT) + ":9600,N,8,1,CS,DS,CD,RS"
     OPEN SER$ FOR RANDOM AS #COMFILE
     WIDTH #COMFILE, 255
     CALL ClrBuf(COMFILE)                'clear input buffer
     IniPrg = MCREG
END FUNCTION

FUNCTION RecMsg$ (COMFILE)
   '******** receive message from instrument ******************
   Del = 1                                  'communication delay
   REC$ = ""                                'clear response string
   DO
      TR! = TIMER                            'start timeout timer
      DO
         IF TIMER < TR! THEN TR! = TR! - 86400!     'adjust 24.00h
      LOOP UNTIL (LOC(COMFILE) > 0) OR (TIMER - TR! > Del)

      IF LOC(COMFILE) = 0 THEN               'if there no characters
         PRINT "**** receive timeout ****"
         Stp = 1
      ELSE
         C$ = INPUT$(1, #COMFILE)             'read one character
         CALL SetDTR(1)                       'set DTR on
         IF NOT C$ = CHR$(10) THEN
            REC$ = REC$ + C$                  'append character
         END IF
      END IF
   LOOP UNTIL ((C$ = CHR$(10)) OR (Stp = 1))
   RecMsg$ = REC$
END FUNCTION
```


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

```
SUB SetDTR (Cnt)
    '******** buffer size check *********************************
    IF Cnt = 0 THEN
     'if input buffer becomes full then reset DTR to stop transmission
        IF LOC(COMFILE) > 200 THEN
           OUT MCREG, INP(MCREG) AND 254            'set DTR off
        END IF
     ELSE
     'if input buffer has enough space then  continue transmission
        IF LOC(COMFILE) < 100 THEN
           OUT MCREG, INP(MCREG) OR 3               'set DTR on
        END IF
     END IF
END SUB

SUB SndCmd (WR$)

    '******** send command to instrument ************************
     IF NOT LEFT$(WR$, 1) = CHR$(27) THEN
        WR$ = WR$ + CHR$(10)                  'append terminator
     END IF
     PRINT #COMFILE, WR$;                     'send command string
END SUB

SUB SndMsg (WR$)
    PRINT #COMFILE, WR$;                      'send command string

    T1 = TIMER
    WHILE (T1 + .1 > TIMER)                   'delay 100ms
    WEND
    IF (INSTR(WR$, "?") > 0) OR Chk = 3 THEN  'if a query
       REC$ = RecMsg$(COMFILE)                'get response message
       PRINT
       PRINT "RESPONSE :  "; REC$
    END IF
    WR$ = CHR$(27) + "7"
    CALL SndCmd(WR$)                          'sends get status byte
    Sts% = VAL(RecMsg$(COMFILE))
    IF (Sts% AND 32) THEN                     'checks wether ESB is set
       BEEP
       WR$ = "err?"
       CALL SndCmd(WR$)                       'sends command
       REC$ = RecMsg$(COMFILE)
       PRINT
       PRINT " ERROR : "; REC$
       WR$ = "*cls"
       CALL SndCmd(WR$)                       'clear status register
    END IF
END SUB
```

PM6304 PROGRAMMING EXAMPLES FOR IEEE−488 and RS−232 4 − 7


```
SUB SetDTR (Cnt)
    '******** buffer size check *********************************
    IF Cnt = 0 THEN
     'if input buffer becomes full then reset DTR to stop transmission
        IF LOC(COMFILE) > 200 THEN
           OUT MCREG, INP(MCREG) AND 254            'set DTR off
        END IF
     ELSE
     'if input buffer has enough space then  continue transmission
        IF LOC(COMFILE) < 100 THEN
           OUT MCREG, INP(MCREG) OR 3               'set DTR on
        END IF
     END IF
END SUB

SUB SndCmd (WR$)

    '******** send command to instrument ************************
     IF NOT LEFT$(WR$, 1) = CHR$(27) THEN
        WR$ = WR$ + CHR$(10)                  'append terminator
     END IF
     PRINT #COMFILE, WR$;                     'send command string
END SUB

SUB SndMsg (WR$)
    PRINT #COMFILE, WR$;                      'send command string

    T1 = TIMER
    WHILE (T1 + .1 > TIMER)                   'delay 100ms
    WEND
    IF (INSTR(WR$, "?") > 0) OR Chk = 3 THEN  'if a query
       REC$ = RecMsg$(COMFILE)                'get response message
       PRINT
       PRINT "RESPONSE :  "; REC$
    END IF
    WR$ = CHR$(27) + "7"
    CALL SndCmd(WR$)                          'sends get status byte
    Sts% = VAL(RecMsg$(COMFILE))
    IF (Sts% AND 32) THEN                     'checks wether ESB is set
       BEEP
       WR$ = "err?"
       CALL SndCmd(WR$)                       'sends command
       REC$ = RecMsg$(COMFILE)
       PRINT
       PRINT " ERROR : "; REC$
       WR$ = "*cls"
       CALL SndCmd(WR$)                       'clear status register
    END IF
END SUB
```


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

PRINTING OF MEASUREMENT RESULTS

Chapter 5

PRINTING OF MEASUREMENT RESULTS

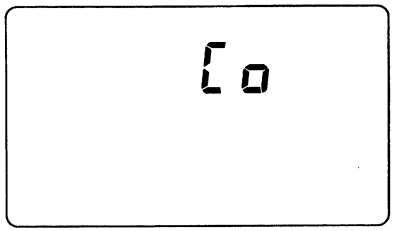
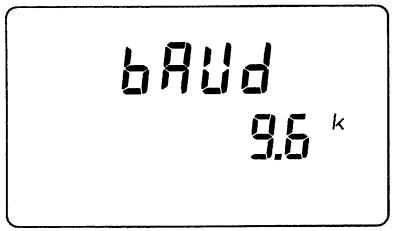
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

5 PRINTING OF MEASUREMENT RESULTS

The PM6304 / PM6404C RCL Meter can send measurement results directly to a printer without any special program or PC.

- Select an appropiate measurement setup;
  select required instrument settings for measurement.
- Set the interface configuration in accordance with your printer, see Chapter 2.1, and refer to your printer manual if necessary.
- Connect the RCL meter to the printer via the RS-232 cable as shown on Page 5 – 3.
- Set the Operating Mode of the interface to Printer Mode (**Pr**) by pressing the **INTERFACE** and **STEP** keys. The instrument is automatically set to single measurement mode.

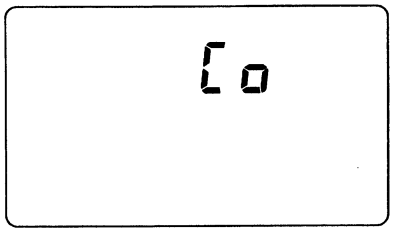
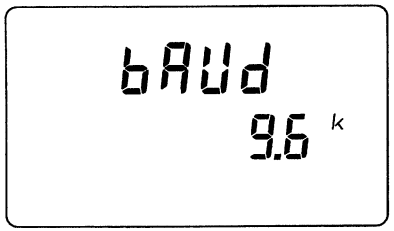
Function and Key Operation	Display
INTERFACE	
INTERFACE	
	display shows current configuration

PM6304 PRINTING OF MEASUREMENT RESULTS 5 – 1

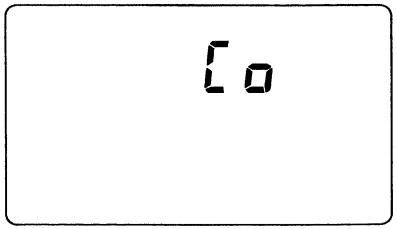
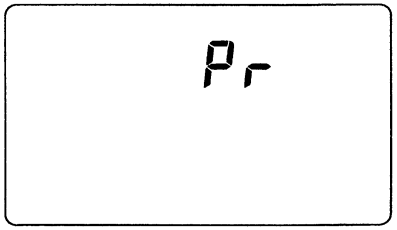
5 PRINTING OF MEASUREMENT RESULTS

The PM6304 / PM6404C RCL Meter can send measurement results directly to a printer without any special program or PC.

- Select an appropiate measurement setup;
  select required instrument settings for measurement.
- Set the interface configuration in accordance with your printer, see Chapter 2.1, and refer to your printer manual if necessary.
- Connect the RCL meter to the printer via the RS-232 cable as shown on Page 5 – 3.
- Set the Operating Mode of the interface to Printer Mode (**Pr**) by pressing the **INTERFACE** and **STEP** keys. The instrument is automatically set to single measurement mode.

Function and Key Operation	Display
INTERFACE	
INTERFACE	
	display shows current configuration

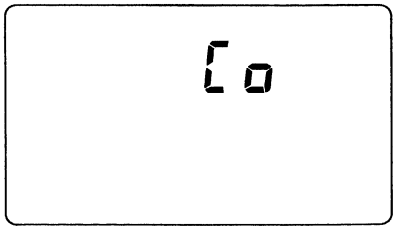
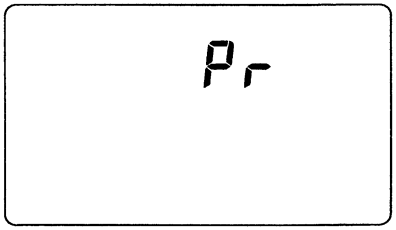
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Function and Key Operation	Display
INTERFACE 	
STEP – +  select printer mode	

If you do not press the **INTERFACE** key within 3 seconds, the instrument returns automatically to measurement mode, the altered settings are not stored.

Press the **INTERFACE** key to step completely through the menus until the normal display appears.

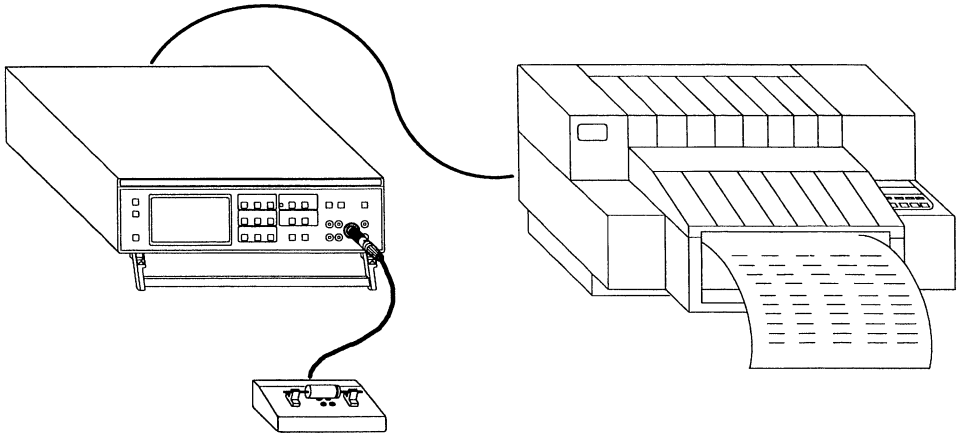
5 – 2 PRINTING OF MEASUREMENT RESULTS PM6304

Function and Key Operation	Display
INTERFACE 	
STEP – +  select printer mode	

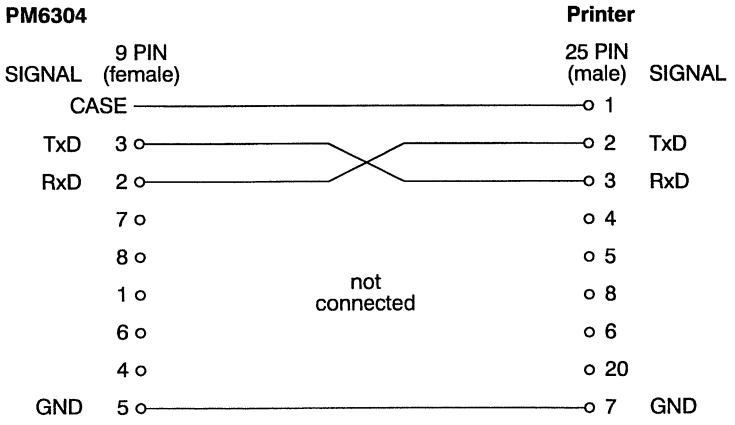
If you do not press the **INTERFACE** key within 3 seconds, the instrument returns automatically to measurement mode, the altered settings are not stored.

Press the **INTERFACE** key to step completely through the menus until the normal display appears.

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

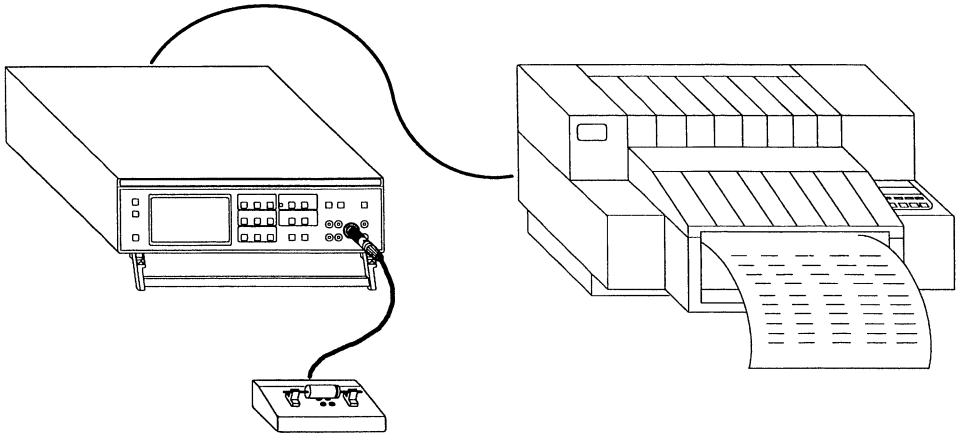


Connection cable

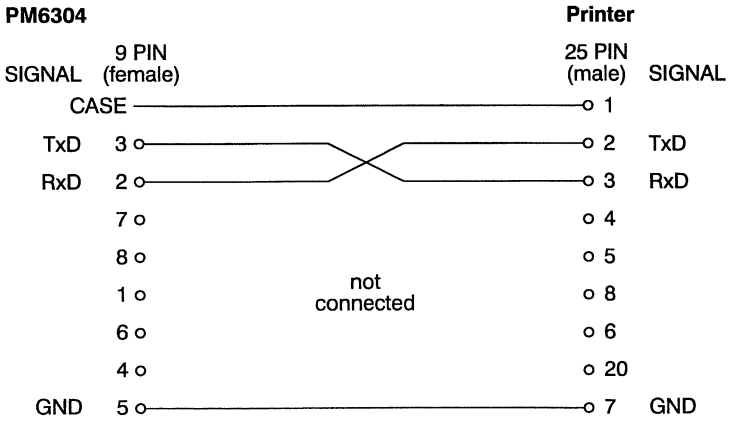


Xon/Xoff software handshake must be switched on.

PM6304 PRINTING OF MEASUREMENT RESULTS 5 – 3



Connection cable



Xon/Xoff software handshake must be switched on.

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

- The printer prints the first header line.
- Insert a component and press the **TRIGGER** key to start a measurement.
- The printer prints the second header line and the measurement result.
- Insert a different component, and press the **TRIGGER** key.
- The printer prints the result, etc.

Example of a print:

PM6304 RCL METER : TEST PROTOCOL FLUKE

NO	DOMINANT	SECOND	CIRCUIT	MODE	FREQ	LEVEL	BIAS
1	R=79.13 kOhm	C=10.08 nF	Par	Auto	100 Hz	Norm	Off
2	C=10.059 nF	R=78.34 kOhm	Par	Auto	1.0 kHz	Norm	Off
3	C=10.062 nF	R=78.3 kOhm	Par	Auto	10.0 kHz	Norm	Off
4	C=10.070 nF	R=35.5 kOhm	Par	Auto	100 kHz	Norm	Off
5	C=10.059 nF	Z=15.51 kOhm	Par	Par	1.0 kHz	Norm	Off
6	C=10.059 nF	0=-78.5 deg	Par	Par	1.0 kHz	Norm	Off
7	C=10.060 nF	D=.202	Par	Par	1.0 kHz	Norm	Off
8	C=10.059 nF	Q=4.95	Par	Par	1.0 kHz	Norm	Off
9	C=10.470 nF	R=3.070 kOhm	Ser	Ser	1.0 kHz	Norm	Off
10	R=79.144 kOhm	----	----	----	DC	Norm	Off
11	R=19.937 kOhm	C=4.83 uF	Ser	Ser	1.0 kHz	Norm	Off
12	R=19.938 kOhm	C=13.5 pF	Par	Auto	1.0 kHz	Norm	Off
13	R=19.940 kOhm	Z=19.94 kOhm	Par	Par	1.0 kHz	Norm	Off
14	R=19.941 kOhm	D=591	Par	Par	1.0 kHz	Norm	Off
15	R=19.941 kOhm	Q=.002	Par	Par	1.0 kHz	Norm	Off
16	R=19.96 kOhm	Q=.002	Par	Par	1.0 kHz	Low	Off
17	R=19.96 kOhm	Q=.002	Par	Par	1.0 kHz	Low	Off
18	R=19.946 kOhm	Q=.002	Par	Par	1.0 kHz	High	Off
19	R=19.951 kOhm	C=13.0 pF	Par	Auto	1.0 kHz	Norm	Off
20	R=120.91 kOhm	C=21.5 pF	Par	Auto	1.0 kHz	Norm	Off
21	R=120.86 kOhm	C=80.4 nF	Ser	Ser	1.0 kHz	Norm	Off
22	R=120.89 kOhm	Z=120.9 kOhm	Par	Par	1.0 kHz	Norm	Off
23	R=120.90 kOhm	D=61.5	Par	Par	1.0 kHz	Norm	Off
24	R=120.91 kOhm	Q=.016	Par	Par	1.0 kHz	Norm	Off
25	R=120.89 kOhm	Q=.016	Par	Par	1.0 kHz	Norm	Off

To leave the Printer Mode set the PM6304 to Communication Mode by pressing the **INTERFACE** and **STEP** keys as mentioned before.

5 – 4 PRINTING OF MEASUREMENT RESULTS PM6304

- The printer prints the first header line.
- Insert a component and press the **TRIGGER** key to start a measurement.
- The printer prints the second header line and the measurement result.
- Insert a different component, and press the **TRIGGER** key.
- The printer prints the result, etc.

Example of a print:

PM6304 RCL METER : TEST PROTOCOL FLUKE

NO	DOMINANT	SECOND	CIRCUIT	MODE	FREQ	LEVEL	BIAS
1	R=79.13 kOhm	C=10.08 nF	Par	Auto	100 Hz	Norm	Off
2	C=10.059 nF	R=78.34 kOhm	Par	Auto	1.0 kHz	Norm	Off
3	C=10.062 nF	R=78.3 kOhm	Par	Auto	10.0 kHz	Norm	Off
4	C=10.070 nF	R=35.5 kOhm	Par	Auto	100 kHz	Norm	Off
5	C=10.059 nF	Z=15.51 kOhm	Par	Par	1.0 kHz	Norm	Off
6	C=10.059 nF	0=-78.5 deg	Par	Par	1.0 kHz	Norm	Off
7	C=10.060 nF	D=.202	Par	Par	1.0 kHz	Norm	Off
8	C=10.059 nF	Q=4.95	Par	Par	1.0 kHz	Norm	Off
9	C=10.470 nF	R=3.070 kOhm	Ser	Ser	1.0 kHz	Norm	Off
10	R=79.144 kOhm	----	----	----	DC	Norm	Off
11	R=19.937 kOhm	C=4.83 uF	Ser	Ser	1.0 kHz	Norm	Off
12	R=19.938 kOhm	C=13.5 pF	Par	Auto	1.0 kHz	Norm	Off
13	R=19.940 kOhm	Z=19.94 kOhm	Par	Par	1.0 kHz	Norm	Off
14	R=19.941 kOhm	D=591	Par	Par	1.0 kHz	Norm	Off
15	R=19.941 kOhm	Q=.002	Par	Par	1.0 kHz	Norm	Off
16	R=19.96 kOhm	Q=.002	Par	Par	1.0 kHz	Low	Off
17	R=19.96 kOhm	Q=.002	Par	Par	1.0 kHz	Low	Off
18	R=19.946 kOhm	Q=.002	Par	Par	1.0 kHz	High	Off
19	R=19.951 kOhm	C=13.0 pF	Par	Auto	1.0 kHz	Norm	Off
20	R=120.91 kOhm	C=21.5 pF	Par	Auto	1.0 kHz	Norm	Off
21	R=120.86 kOhm	C=80.4 nF	Ser	Ser	1.0 kHz	Norm	Off
22	R=120.89 kOhm	Z=120.9 kOhm	Par	Par	1.0 kHz	Norm	Off
23	R=120.90 kOhm	D=61.5	Par	Par	1.0 kHz	Norm	Off
24	R=120.91 kOhm	Q=.016	Par	Par	1.0 kHz	Norm	Off
25	R=120.89 kOhm	Q=.016	Par	Par	1.0 kHz	Norm	Off

To leave the Printer Mode set the PM6304 to Communication Mode by pressing the **INTERFACE** and **STEP** keys as mentioned before.

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

Chapter 6

ERROR MESSAGES

Chapter 6

ERROR MESSAGES

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

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

6 ERROR MESSAGES

After receiving the query **ERR?** the instrument generates a response message with an error number and an error description in clear text, which can be read in by the controller.

Error Message	see
ERROR0/NO ERROR	
ERROR101/PROM CHECKSUM ERROR	SM
ERROR102/INTERNAL RAM ERROR	SM
ERROR103/EXTERNAL RAM ERROR	SM
ERROR104/BACKUP ERROR	SM
ERROR105/EXTERNAL MEMORY ERROR	SM
ERROR107/EEPROM ERROR	SM
ERROR108/EEPROM ERROR: TRIMM DATA	SM
ERROR109/EEPROM ERROR: CAL.DATA	SM
ERROR110/EEPROM ERROR: BINNING DATA	SM
ERROR111/HARDWARE ERROR	SM
ERROR112/DISPLAY ERROR	SM
ERROR113/TIME OUT ERROR	
ERROR114/ERROR DURING TRIMMING	UM, Section 4.3
ERROR115/TRIMMING RESISTANCE OUT OF RANGE	UM, Section 4.3
ERROR117/OVERLOADED	UM, Section 4.7
ERROR118/BINNING SET IS EMPTY	PM, Section 3.5.2
ERROR120/CALIBRATION ERROR	SM, Section
ERROR140/REFERENCE RESISTANCE OUT OF RANGE	SM
ERROR142/ILLEGAL REGISTER ADDRESS	PM, Section 3.5
ERROR143/ILLEGAL BINNING NUMBER	PM, Section 3.5.2
ERROR144/DATA INCOMPLETE	PM, Section 3.5.2
ERROR145/BINNING SET IS EMPTY	PM, Section 3.5.2
ERROR146/BINNING SET IS NOT CONSISTENT	PM, Section 3.5.2
ERROR150/SYNTAX ERROR	PM, Section 3.1

PM6304 ERROR MESSAGES 6 – 1

6 ERROR MESSAGES

After receiving the query **ERR?** the instrument generates a response message with an error number and an error description in clear text, which can be read in by the controller.

Error Message	see
ERROR0/NO ERROR	
ERROR101/PROM CHECKSUM ERROR	SM
ERROR102/INTERNAL RAM ERROR	SM
ERROR103/EXTERNAL RAM ERROR	SM
ERROR104/BACKUP ERROR	SM
ERROR105/EXTERNAL MEMORY ERROR	SM
ERROR107/EEPROM ERROR	SM
ERROR108/EEPROM ERROR: TRIMM DATA	SM
ERROR109/EEPROM ERROR: CAL.DATA	SM
ERROR110/EEPROM ERROR: BINNING DATA	SM
ERROR111/HARDWARE ERROR	SM
ERROR112/DISPLAY ERROR	SM
ERROR113/TIME OUT ERROR	
ERROR114/ERROR DURING TRIMMING	UM, Section 4.3
ERROR115/TRIMMING RESISTANCE OUT OF RANGE	UM, Section 4.3
ERROR117/OVERLOADED	UM, Section 4.7
ERROR118/BINNING SET IS EMPTY	PM, Section 3.5.2
ERROR120/CALIBRATION ERROR	SM, Section
ERROR140/REFERENCE RESISTANCE OUT OF RANGE	SM
ERROR142/ILLEGAL REGISTER ADDRESS	PM, Section 3.5
ERROR143/ILLEGAL BINNING NUMBER	PM, Section 3.5.2
ERROR144/DATA INCOMPLETE	PM, Section 3.5.2
ERROR145/BINNING SET IS EMPTY	PM, Section 3.5.2
ERROR146/BINNING SET IS NOT CONSISTENT	PM, Section 3.5.2
ERROR150/SYNTAX ERROR	PM, Section 3.1

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

Error Message	see
ERROR151/ILLEGAL HEADER	PM, Chapter 7
ERROR152/BODY SYNTAX ERROR	PM, Chapter 7
ERROR153/DATA OUT OF RANGE	RM, Chapter 1
ERROR154/NO QUERY HEADER	PM, Chapter 7
ERROR155/NO OUTPUT DATA AVAILABLE	
ERROR156/OUTPUT DATA DESTROYED	
ERROR158/TIME OUT	
ERROR159/VALUE OUT OF RANGE	RM, Chapter 1
ERROR161/RESISTANCE OUT OF RANGE	RM, Chapter 1
ERROR162/CAPACITANCE OUT OF RANGE	RM, Chapter 1
ERROR163/INDUCTANCE OUT OF RANGE	RM, Chapter 1
ERROR164/IMPEDANCE OUT OF RANGE	RM, Chapter 1
ERROR165/QUALITY OUT OF RANGE	RM, Chapter 1
ERROR166/DISSIPATION OUT OF RANGE	RM, Chapter 1
ERROR167/PHASE OUT OF RANGE	RM, Chapter 1
ERROR168/DC MEASURE NOT AVAILABLE	
ERROR169/NO TRIGGER POSSIBLE	PM, Section 3.5
ERROR170/ILLEGAL PARAMETER	PM, Chapter 7
ERROR171/FREQUENCY OUT OF RANGE	PM, Section 3.5.1
ERROR172/FREQUENCY OUT OF RASTER	PM, Section 3.5.1
ERROR173/FREQUENCY CORRECTED	PM, Section 3.5.1
ERROR174/DC–BIAS NOT POSSIBLE	
ERROR175/NO CONTINUOUS MODE IN FAST	PM, Section 3.5.1.6
ERROR176/NO CHANGE IN BINNING MODE	PM, Section 3.5.2.3
ERROR177/LEAVE BINNING MODE FIRST	PM, Section 3.5.2.3
ERROR178/LEAVE CALIBRATION MODE FIRST	SM
ERROR179/NO RANGE HOLD IN CONT.MODE	PM, Section 3.5.3
ERROR180/NO AVERAGE IN FAST MODE	PM, Section 3.5.1.6
ERROR199/UNKNOWN ERROR	

PM = Programmers Manual
UM = Users Manual
RM = Reference Manual
SM = Service Manual

6 – 2 ERROR MESSAGES PM6304

Error Message	see
ERROR151/ILLEGAL HEADER	PM, Chapter 7
ERROR152/BODY SYNTAX ERROR	PM, Chapter 7
ERROR153/DATA OUT OF RANGE	RM, Chapter 1
ERROR154/NO QUERY HEADER	PM, Chapter 7
ERROR155/NO OUTPUT DATA AVAILABLE	
ERROR156/OUTPUT DATA DESTROYED	
ERROR158/TIME OUT	
ERROR159/VALUE OUT OF RANGE	RM, Chapter 1
ERROR161/RESISTANCE OUT OF RANGE	RM, Chapter 1
ERROR162/CAPACITANCE OUT OF RANGE	RM, Chapter 1
ERROR163/INDUCTANCE OUT OF RANGE	RM, Chapter 1
ERROR164/IMPEDANCE OUT OF RANGE	RM, Chapter 1
ERROR165/QUALITY OUT OF RANGE	RM, Chapter 1
ERROR166/DISSIPATION OUT OF RANGE	RM, Chapter 1
ERROR167/PHASE OUT OF RANGE	RM, Chapter 1
ERROR168/DC MEASURE NOT AVAILABLE	
ERROR169/NO TRIGGER POSSIBLE	PM, Section 3.5
ERROR170/ILLEGAL PARAMETER	PM, Chapter 7
ERROR171/FREQUENCY OUT OF RANGE	PM, Section 3.5.1
ERROR172/FREQUENCY OUT OF RASTER	PM, Section 3.5.1
ERROR173/FREQUENCY CORRECTED	PM, Section 3.5.1
ERROR174/DC–BIAS NOT POSSIBLE	
ERROR175/NO CONTINUOUS MODE IN FAST	PM, Section 3.5.1.6
ERROR176/NO CHANGE IN BINNING MODE	PM, Section 3.5.2.3
ERROR177/LEAVE BINNING MODE FIRST	PM, Section 3.5.2.3
ERROR178/LEAVE CALIBRATION MODE FIRST	SM
ERROR179/NO RANGE HOLD IN CONT.MODE	PM, Section 3.5.3
ERROR180/NO AVERAGE IN FAST MODE	PM, Section 3.5.1.6
ERROR199/UNKNOWN ERROR	

PM = Programmers Manual
UM = Users Manual
RM = Reference Manual
SM = Service Manual

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

Chapter 7

COMMANDS IN ALPHABETICAL ORDER

Chapter 7

COMMANDS IN ALPHABETICAL ORDER

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

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

7 COMMANDS IN ALPHABETICAL ORDER

7.1 COMMON COMMANDS AND QUERIES (IEEE-488.2)

Command/Query	Description	Page
★**CLS**	Sets 'Standard Event Status Register' and 'Status Register' to zero	3 – 7
★**ESE** <NRf>	'Standard Event Status Enable' Command	3 – 7
★**ESE?**	'Standard Event Status Enable' Query	3 – 7
★**ESR?**	Reads 'Standard Event Status Register'	3 – 7
★**IDN?**	Identification Query	3 – 4
★**LRN?**	Learn Device Setup Query	3 – 4
★**OPC**	'Operation Complete' Command	3 – 5
★**OPC?**	'Operation Complete' Query	3 – 6
★**RCL 1...9**	Recall Command	3 – 8 / 18
★**RST**	Reset Command	3 – 4
★**SAV 1...9**	Save Command	3 – 8 / 18
★**SRE** <NRf>	'Service Request Enable' Command	3 – 7
★**SRE?**	'Service Request Enable' Query	3 – 7
★**STB?**	Reads Status Byte	3 – 8
★**TRG**	Trigger Command	3 – 7
★**TST?**	Self-test Query	3 – 5
★**WAI**	Wait-to-Continue Command	3 – 6

PM6304 COMMANDS IN ALPHABETICAL ORDER 7 – 1

7 COMMANDS IN ALPHABETICAL ORDER

7.1 COMMON COMMANDS AND QUERIES (IEEE-488.2)

Command/Query Description Page

★CLS Sets 'Standard Event Status Register' and 'Status Register' to zero 3 – 7

★ESE <NRf> 'Standard Event Status Enable' Command 3 – 7
★ESE? 'Standard Event Status Enable' Query 3 – 7
★ESR? Reads 'Standard Event Status Register' 3 – 7

★IDN? Identification Query 3 – 4

★LRN? Learn Device Setup Query 3 – 4

★OPC 'Operation Complete' Command 3 – 5
★OPC? 'Operation Complete' Query 3 – 6

★RCL 1...9 Recall Command 3 – 8 / 18
★RST Reset Command 3 – 4

★SAV 1...9 Save Command 3 – 8 / 18
★SRE <NRf> 'Service Request Enable' Command 3 – 7
★SRE? 'Service Request Enable' Query 3 – 7
★STB? Reads Status Byte 3 – 8

★TRG Trigger Command 3 – 7
★TST? Self-test Query 3 – 5

★WAI Wait-to-Continue Command 3 – 6

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

7.2 DEVICE SPECIFIC COMMANDS

7.2.1 Settings and Measurements

Command/Query	Description	Page
AUTO	Automatic measurement mode	3 – 10
AVG?	Asks for averaging	3 – 25
AVG ON	Increased averaging	3 – 25
AVG OFF	Normal averaging	3 – 25
CAL?	Asks for last valid calibration	3 – 27
CAP?	Asks for capacitance value	3 – 16
COM?	Asks for dominant/secondary parameter	3 – 16
CON	Continuous measurement	3 – 15
CUR?	Asks for measured current	3 – 16
DC_BIAS?	Asks for DC bias voltage	3 – 13
DC_BIAS EXT	External DC bias	3 – 13
DC_BIAS INT	Internal DC bias	3 – 13
DC_BIAS OFF	No DC bias	3 – 13
DISS?	Asks for dissipation factor value	3 – 16
ERR?	Asks for error messages	6 – 1
FRE <NRf>	Sets test signal frequency	3 – 12
FRE?	Asks for test signal frequency	3 – 12
IMP?	Asks for impedance value	3 – 16
INDU?	Asks for inductance value	3 – 16
LEV?	Asks for test signal voltage	3 – 13
LEV HI	Test signal voltage 2 V	3 – 13
LEV NO	Test signal voltage 1 V	3 – 13
LEV LO	Test signal voltage 50 mV AC, 300 mV DC	3 – 13
LOCK?	Asks for locked parameter	3 – 27
LOCK R	Locks to resistance	3 – 27
LOCK C	Locks to capacitance	3 – 27
LOCK L	Locks to inductance	3 – 27
LOCK OFF	Switches LOCK function off	3 – 27

7 – 2 COMMANDS IN ALPHABETICAL ORDER PM6304

7.2 DEVICE SPECIFIC COMMANDS

7.2.1 Settings and Measurements

Command/Query	Description	Page
AUTO	Automatic measurement mode	3 – 10
AVG?	Asks for averaging	3 – 25
AVG ON	Increased averaging	3 – 25
AVG OFF	Normal averaging	3 – 25
CAL?	Asks for last valid calibration	3 – 27
CAP?	Asks for capacitance value	3 – 16
COM?	Asks for dominant/secondary parameter	3 – 16
CON	Continuous measurement	3 – 15
CUR?	Asks for measured current	3 – 16
DC_BIAS?	Asks for DC bias voltage	3 – 13
DC_BIAS EXT	External DC bias	3 – 13
DC_BIAS INT	Internal DC bias	3 – 13
DC_BIAS OFF	No DC bias	3 – 13
DISS?	Asks for dissipation factor value	3 – 16
ERR?	Asks for error messages	6 – 1
FRE <NRf>	Sets test signal frequency	3 – 12
FRE?	Asks for test signal frequency	3 – 12
IMP?	Asks for impedance value	3 – 16
INDU?	Asks for inductance value	3 – 16
LEV?	Asks for test signal voltage	3 – 13
LEV HI	Test signal voltage 2 V	3 – 13
LEV NO	Test signal voltage 1 V	3 – 13
LEV LO	Test signal voltage 50 mV AC, 300 mV DC	3 – 13
LOCK?	Asks for locked parameter	3 – 27
LOCK R	Locks to resistance	3 – 27
LOCK C	Locks to capacitance	3 – 27
LOCK L	Locks to inductance	3 – 27
LOCK OFF	Switches LOCK function off	3 – 27

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

Command/Query	Description	Page
MEA_FAST?	Asks for fast measurement mode	3 – 15
MEA_FAST OFF	Fast measurement off	3 – 15
MEA_FAST ON	Fast measurement on	3 – 15
MODE?	Asks for measuring mode	3 – 10
PHA?	Asks for phase angle value	3 – 16
PARAL	Sets parallel measurement mode	3 – 10
PARAM?	Asks for selected parameter	3 – 11
PARAM CUR	Current is displayed	3 – 11
PARAM DISS	Dissipation factor is displayed	3 – 11
PARAM IMP	Impedance is displayed	3 – 11
PARAM PHA	Phase angle is displayed	3 – 11
PARAM QUA	Quality factor is displayed	3 – 11
PARAM VOL	Voltage is displayed	3 – 11
PARAM AUTO	Sets measurement selected before	3 – 11
QUAL?	Asks for quality factor value	3 – 16
RESI?	Asks for resistance value	3 – 16
RNG_HOLD?	Asks for hold function	3 – 26
RNG_HOLD OFF	Internal gain factor is automatically determined	3 – 26
RNG_HOLD ON	Internal gain factor is fixed	3 – 26
SER	Sets serial measuring mode	3 – 10
SIN	Single measurement	3 – 15
TEST_SIG?	Asks for test signal	3 – 12
TEST_SIG AC	AC test signal	3 – 12
TEST_SIG DC	DC test signal	3 – 12
TRIG	Starts single measurement	3 – 15
TRIG?	Asks for single or continuous measurement	3 – 15
TRIM	Performs open/short-circuit trimming	3 – 11
TRM <NR1>	Defines message terminator	3 – 1
VOL?	Asks for voltage value	3 – 16

PM6304 COMMANDS IN ALPHABETICAL ORDER 7 – 3

Command/Query	Description	Page
MEA_FAST?	Asks for fast measurement mode	3 – 15
MEA_FAST OFF	Fast measurement off	3 – 15
MEA_FAST ON	Fast measurement on	3 – 15
MODE?	Asks for measuring mode	3 – 10
PHA?	Asks for phase angle value	3 – 16
PARAL	Sets parallel measurement mode	3 – 10
PARAM?	Asks for selected parameter	3 – 11
PARAM CUR	Current is displayed	3 – 11
PARAM DISS	Dissipation factor is displayed	3 – 11
PARAM IMP	Impedance is displayed	3 – 11
PARAM PHA	Phase angle is displayed	3 – 11
PARAM QUA	Quality factor is displayed	3 – 11
PARAM VOL	Voltage is displayed	3 – 11
PARAM AUTO	Sets measurement selected before	3 – 11
QUAL?	Asks for quality factor value	3 – 16
RESI?	Asks for resistance value	3 – 16
RNG_HOLD?	Asks for hold function	3 – 26
RNG_HOLD OFF	Internal gain factor is automatically determined	3 – 26
RNG_HOLD ON	Internal gain factor is fixed	3 – 26
SER	Sets serial measuring mode	3 – 10
SIN	Single measurement	3 – 15
TEST_SIG?	Asks for test signal	3 – 12
TEST_SIG AC	AC test signal	3 – 12
TEST_SIG DC	DC test signal	3 – 12
TRIG	Starts single measurement	3 – 15
TRIG?	Asks for single or continuous measurement	3 – 15
TRIM	Performs open/short-circuit trimming	3 – 11
TRM <NR1>	Defines message terminator	3 – 1
VOL?	Asks for voltage value	3 – 16

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

7.2.2 Commands for Binning

Command/Query	Description	Page
BIN <NR1>	Allocates data to bins 0 to 9	3 – 21
BIN?	Asks for the bin the component is allocated to	3 – 25
BIN OFF	Normal measuring mode	3 – 24
BIN ON	Binning mode	3 – 24
BIN_ABS	Input af absolute values	3 – 21
BIN_DISABL <NR1>	Disables selected bin	3 – 24
BIN_ENABL <NR1>	Enables selected bin	3 – 24
BIN_ERA <NR1>	Deletes selected bin set	3 – 23
BIN_RCL <NR1>	Loads bin set into register 0	3 – 23
BIN_REL	Input of tolerances in percent	3 – 21
BIN_SET? <NR1>	Asks for selected bin set	3 – 23
BIN_STO <NR1>	Stores bin set into register 1 to 9	3 – 23
BUF_BIN? <NR1>	Asks for the selected bin from the buffer for editing	3 – 23
BUF_CLR	Deletes buffer for editing	3 – 23
BUF_RCL <NR1>	Loads selected bin set into buffer for editing	3 – 23
CAP	Capacitance; absolute	3 – 21
CAP <NRf>	Capacitance; nominal	3 – 21
DISS	Dissipation factor; absolute	3 – 21
DISS <NRf>	Dissipaton factor; nominal	3 – 21
IMP	Impedance; absolute	3 – 21
IMP <NRf>	Impedance; nominal	3 – 21
INDU	Inductance; absolute	3 – 21
INDU <NRf>	Inductance, nominal	3 – 21
LIM_HI	Upper tolerance limit	3 – 21
LIM_LO	Lower tolerance limit	3 – 21
PHA	Phase angle; absolute	3 – 21
PHA <NRf>	Phase angle; nominal	3 – 21
QUA	Quality factor; absolute	3 – 21
QUA <NRf>	Quality factor; nominal	3 – 21
RESI	Resistance; absolute	3 – 21
RESI <NRf>	Resistance; nominal	3 – 21

7 – 4 COMMANDS IN ALPHABETICAL ORDER PM6304

7.2.2 Commands for Binning

Command/Query Description Page

BIN <NR1> Allocates data to bins 0 to 9 3 – 21
BIN? Asks for the bin the component is allocated to 3 – 25
BIN OFF Normal measuring mode 3 – 24
BIN ON Binning mode 3 – 24
BIN_ABS Input af absolute values 3 – 21
BIN_DISABL <NR1> Disables selected bin 3 – 24
BIN_ENABL <NR1> Enables selected bin 3 – 24
BIN_ERA <NR1> Deletes selected bin set 3 – 23
BIN_RCL <NR1> Loads bin set into register 0 3 – 23
BIN_REL Input of tolerances in percent 3 – 21
BIN_SET? <NR1> Asks for selected bin set 3 – 23
BIN_STO <NR1> Stores bin set into register 1 to 9 3 – 23
BUF_BIN? <NR1> Asks for the selected bin from the buffer for editing 3 – 23
BUF_CLR Deletes buffer for editing 3 – 23
BUF_RCL <NR1> Loads selected bin set into buffer for editing 3 – 23
CAP Capacitance; absolute 3 – 21
CAP <NRf> Capacitance; nominal 3 – 21
DISS Dissipation factor; absolute 3 – 21
DISS <NRf> Dissipaton factor; nominal 3 – 21
IMP Impedance; absolute 3 – 21
IMP <NRf> Impedance; nominal 3 – 21
INDU Inductance; absolute 3 – 21
INDU <NRf> Inductance, nominal 3 – 21
LIM_HI Upper tolerance limit 3 – 21
LIM_LO Lower tolerance limit 3 – 21
PHA Phase angle; absolute 3 – 21
PHA <NRf> Phase angle; nominal 3 – 21
QUA Quality factor; absolute 3 – 21
QUA <NRf> Quality factor; nominal 3 – 21
RESI Resistance; absolute 3 – 21
RESI <NRf> Resistance; nominal 3 – 21

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