M162 Serial Control Interface

Model: M162

PCB version: Main board 109-16202-00B

Analog board 109-16201-00F

Firmware version: 113-16202-071 or later

Through the serial control interface, the working parameters of the M162 LCR meter can be set and the measurement results can be read by commands. The interface commands can be sent in text format or binary format, and the two types of command can be mixed.

The data format of the serial port transmission is 8 data bits, 1 stop bit, no parity, and the baud rate is 115200 bps.

Text Format Command

The general form of text commands is like below:

CmdName [=Val]

Where CmdName is the identifier of a command, Val is a parameter to be assigned, and the square brackets indicate that the assignment may be omitted. Commands must be terminated with a line feed (LF, 0x0A) or a combination of line feed and a carriage return (CR, 0x0D).

The table below shows the text commands of M162. The contents in bracket are abbreviations.

Command	Descriptions	Value Range	Example/Remarks
R	Enter resistance mode	none	
C	Enter capacitance mode	none	
L	Enter inductance mode	none	
SERIAL（SER）	Select serial equivalent mode	none	
PARALLEL（PAR）	Select parallel equivalent mode	none	
FREQ	Set measurement frequency	100Hz or 1000Hz	Freq = 100Hz
SPEED	Set measurement speed	L2, L1, M, H1 or H2	Speed = H1
SOUT	Turn ON/OFF serial data output	ON or OFF	Sout = ON
SOUTMODE (SMODE)	Set the mode of serial data	ASCII(A) or BINARY(B）	Smode = B
OPENZERO	Open zeroing	none	

（OZ）			
SHORTZERO（SZ）	Short zeroing	none	
READDATA（RD）	Read the current measurement result	none	This command works only when the serial data output is turned off.

Binary Format Command

Binary commands are sent in frames with a certain format. The general format of a frame is as follows.

Offset	Field	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	
1	Frame size	2	Counted from the frame ID to the last byte of payload
3	Command ID	1	
4	Payload	Variable	

Binary format commands must comply with the following three rules:

1) The frame identifier cannot be the sync character (0xFE);
2) At sending, if a 0xFE is encountered, a 0x00 byte must be inserted immediately after it;
3) All multi-byte fields are in little endian order, that is, the lower bytes are sent first;

Note: The 0x00 inserted after a 0xFE data byte is not counted in the frame size at sending, which means that the actual number of bytes sent may be more than the number of bytes indicated by the frame size. At receiving, the inserted 0x00 must be removed to obtain correct data.

For example, if you need to read the current meter settings, you can send the following bytes in sequence

0xFE, 0xE4, 0x04, 0x00, 0x00

1. Read current settings

Command format:

Offset	Field	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xE4
1	Frame size	2	4
3	Command ID	1	0x00

Description: Read the current settings of M162

Return:

Offset	Field	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xE4
1	Frame size	2	6
3	Command ID	1	0x01
4	Setting word 1	1	Bit[2:0] – The primary parameter to be measured 1 – R 2 – C 3 – L Bit[3] – Equivalent circuit 0 – Serial 1 – Parallel Bit[7:4] – Testing frequency 0 – 100Hz 1 – 1000Hz
5	Setting word 2	1	Bit[3:0] – Testing speed 0 – L2 1 – L1 2 – M 3 – H1 4 – H2 Bit[4] – Serial data output 0 – OFF 1 – ON Bit[5] – Serial data output mode 0 – ASCII 1 – Binary

2. Change settings

Command format:

Offset	Field	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xE4
1	Frame size	2	6
3	Command ID	1	0x01
4	Setting word 1	1	Bit[2:0] – The primary parameter to be measured

			1 – R 2 – C 3 – L Bit[3] – Equivalent circuit 0 – 串联 1 – 并联 Bit[7:4] – Testing frequency 0 – 100Hz 1 – 1000Hz
5	Setting word 2	1	Bit[3:0] – Testing speed 0 – L2 1 – L1 2 – M 3 – H1 4 – H2 Bit[4] – Serial data output 0 – OFF 1 – ON Bit[5] – Serial data output mode 0 – ASCII 1 – Binary

Description: Change the settings of M162

Return: none

3. Read measurement result (text format)

Command format:

Offset	**Field**	**Size**	**Value**
-1	Sync character	1	0xFE
0	Frame ID	1	0xE4
1	Frame size	2	4
3	Command ID	1	0x02

Description: This command reads the current measurement result if the serial output function is turned off.. The output is in text format.

Return: Please refer to the last section of this document.

4. Perform open zeroing

Command format:

Offset	Field	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xE4
1	Frame size	2	4
3	Command ID	1	0x03

Description: Perform open zeroing once

Return: none

5. Perform short zeroing

Command format:

Offset	Field	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xE4
1	Frame size	2	4
3	Command ID	1	0x04

Description: Perform short zeroing once

Return: none

6. Read measurement result (binary format)

Command format:

Offset	Field	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xE4
1	Frame size	2	4
3	Command ID	1	0x05

Description: Output the current measurement result in binary format.

Return:

Offset	Field	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xE4
1	Frame size	2	38
3	Command ID	1	0x05
4	Setting word 1	1	Bit[2:0] – The primary parameter to be measured 1 – R 2 – C 3 – L Bit[3] – Equivalent circuit 0 – Serial 1 – Parallel Bit[7:4] – Testing frequency 0 – 100Hz 1 – 1000Hz
5	Setting word 2	1	Bit[3:0] – Testing speed 0 – L2 1 – L1 2 – M 3 – H1 4 – H2 Bit[4] – Serial data output 0 – OFF 1 – ON Bit[5] – Serial data output mode 0 – ASCII 1 – Binary
6	The primary measurement parameter	4	The primary parameter measured under the current test mode and equivalent circuit settings. The value is in floating point format. Units for resistance, capacitance, and inductance are Ohm (Ω), micro-farad (μ F), and micro-henry (μ H) respectively.
10	Q value	4	These are all floating point numbers. The unit for all the impedances is ohm (Ω)
14	D value	4	
18	Equivalent serial resistance	4	
22	The mod of impedance vector	4	
26	The angle of impedance vector	4	
30	The resistance component of impedance vector	4	
34	The reactance component of impedance vector	4	

Details about the format of serial data output in ASCII mode

1. Each measurement is transferred in one line consisting of multiple data fields.
2. All the data fields are ASCII strings and separated with a comma.
3. All the numerical fields are expressed in ASCII coded decimal numbers.
4. The unit of resistance and reactance is ohm (Ω), Their values are output with up to 3 digits fraction (0.001Ω).
5. The unit of capacitance is micro-farad (μF). Capacitance is output with up to 7 digit fraction (0.1pF).
6. The unit of inductance is micro-henry (μH)，Inductance is output with 1 digit fraction (0.1 μH).
7. The unit of impedance angle Θ is degree (°), Impedance angle is output with up to 3 digit fraction.
8. Q value is output with up to 2 digit fraction.
9. D value is output with up to 4 digit fraction.
10. Each line is terminated with one CR character (0x0D) and one LF character (0x0A).

The table below are explanations for each field. The last column is an example of the serial data output from measurement of a 100Ω resistor.

Field #	Definition	Remarks	Example
1	Rs，Rp，Cs，Cp，Ls，或 Lp	The designator of the current primary measurement and the equivalent circuit used.	Rs
2	Primary result	Primary reading	100.958
3	Q value	Secondary readings	0.0
4	D value		230.3028
5	ESR		100.958
6	Impedance magnitude | Z |	Primitive data	100.959
7	Impedance angle Θ		0.249
8	Resistance component Rs		100.958
9	Reactance component Xs		0.438
10	CR（0x0D）and LF（0x0A）	Marks of the end of one line	

This is the example of one line output from a measurement of an 100Ω resistor.

Rs,100.958,0.0,230.3028,100.958,100.959,0.249,100.958,0.438