

Ohmmeter Replacement Guide (From 3540 to RM3544)

- 1. Measurement**
- 2. Functionality**
- 3. External Control (EXT I/O)**
- 4. Commands**

Please prepare copies of the user manuals for the old and new instruments and review the applicable sections of each.

If you do not have access to these manuals, they can be downloaded in PDF format from your myHIOKI website.

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Please note that this guide may be revised or up dated without notice.



ISO 9001
JMI-0216



ISO14001
JQA-E-90091



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1. Measurement

(1) Range structure comparison

3540

Range	Display range	Measurement current	Open terminal voltage
30mΩ	30.00mΩ	100mA	4.0V max
300mΩ	300.0mΩ	100mA	
3Ω	3.000Ω	1mA	
30Ω	30.00Ω	1mA	
300Ω	300.0Ω	1mA	
3kΩ	3.000kΩ	10μA	
30kΩ	30.00kΩ	10μA	

RM3544

Range	Display range	Measurement current	Open terminal voltage
30mΩ	35.000mΩ	300mA	5.5V max
300mΩ	350.00mΩ	300mA	
3Ω	3.5000Ω	30mA	
30Ω	35.000Ω	10mA	
300Ω	350.00Ω	1mA	
3kΩ	3.5000kΩ	1mA	
30kΩ	35.000kΩ	100μA	
300kΩ	350.00kΩ	5μA	
3MΩ	3.5000MΩ	500nA	

The RM3544 has a five-digit display.

- How to set the number of display digits

Menu [P.2/2] Setting screen (SETTING) → Measurement Setting screen (MEAS) → Number of measurement digits (Ω DIGITS)

(2) Temperature sensor

Use of the 9451 Temperature Sensor that came with the 3540 is not recommended. Doing so will cause completely different temperature measured values (around 70°C) to be displayed.

Only use the optional, Hioki-specified Z2001 Temperature Sensor. Please note that the Z2001 is not a standard accessory of the RM3544.

(3) Measurement leads

Use of 3540 measurement leads (9287-10, etc.) with the RM3544 is not recommended (and doing so will place the performance of the instrument outside the accuracy guarantee). The leads that come with the RM3544 and optional measurement leads (L2101, etc.) include a guard terminal in order to reduce the effects of external noise. Although there is no difference in the leads' center value (average value), use of the 3540 measurement leads with the new instrument will make measurement more susceptible to the effects of noise, so their performance should be verified in the environment in which they are to be used first.

If you plan to make your own measurement leads, refers to "10: Making Your Own Measurement Leads" in the RM3544 User Manual.

2. Functionality

(1) Hold function

The RM3544 incorporates an auto-hold function. Please note that the manner in which this function operates differs from the 3540's hold function. If you have been using the 3540's hold function in combination with its EXT I/O functionality, change the RM3544's trigger source to external trigger [EXT].

- How to change the trigger source setting

Menu [P.2/2] Setting screen (SETTING) → EXT I/O Setting screen (I/O) → Set the trigger source (TRIG SOURCE) to external trigger (EXT).

(2) Manual comparator

The RM3544 does not provide functionality that corresponds to the 3540's manual comparator function (MANU signal).

(3) Comparator table

The RM3544's panel load function corresponds to the 3540's comparator table.

- Panel data saved

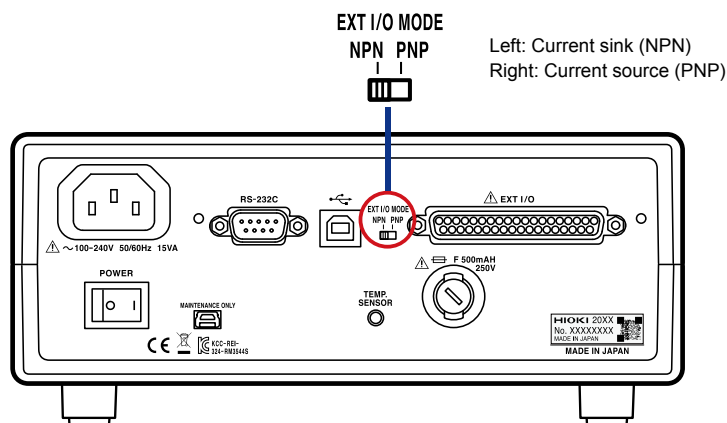
Resistance measurement range, measurement speed, zero-adjustment, averaging, comparator, judgment tone, scaling, temperature correction (TC), auto-hold

3. External Control (EXT I/O)

The timing of some aspects of the RM3544's operation differs from that of the 3540. Be sure to review the timing charts in the RM3544's User Manual.

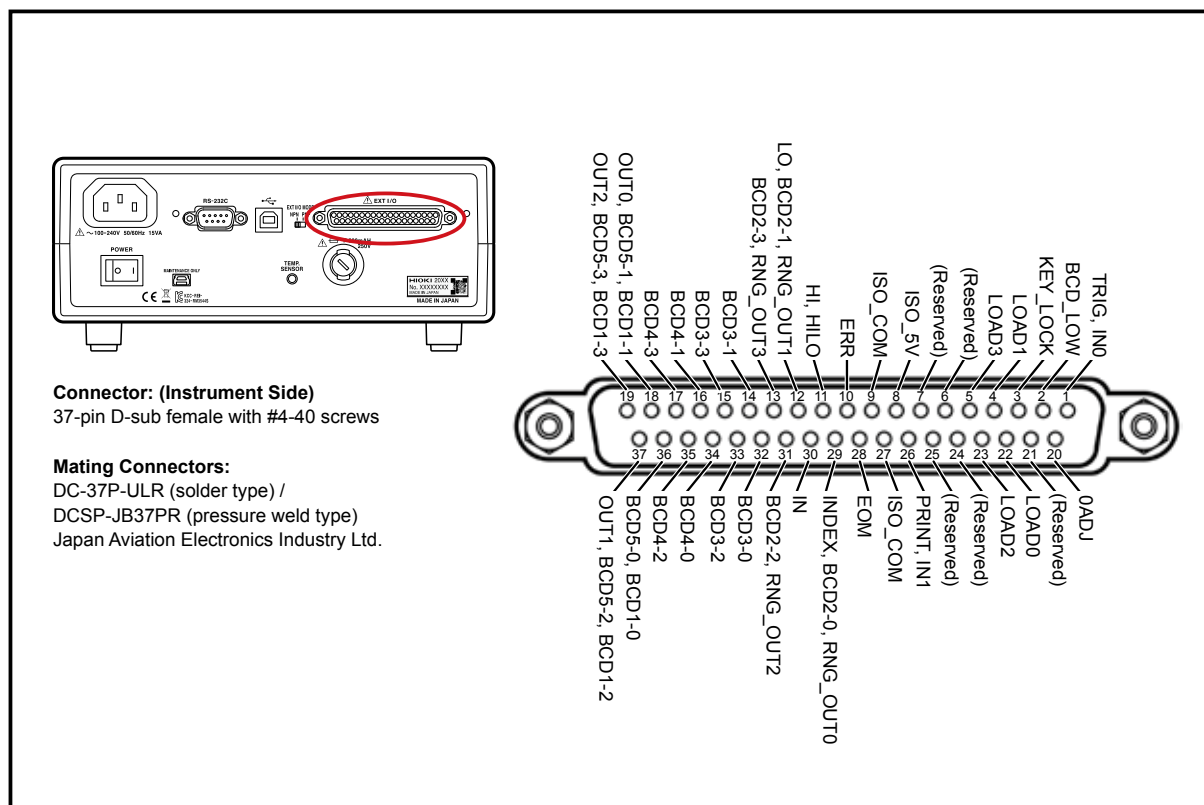
(1) Switching between current sink (NPN) and current source (PNP)

The RM3544 allows you to switch between NPN and PNP operation. To control the instrument in the same way as the 3540, set the NPN/PNP switch to NPN. The instrument ships with the switch in the NPN position. The EXT I/O mode cannot be changed using commands.



(2) Connector

The RM3544 connector is configured as follows:



(3) Signal table

Power		
Description	3540	RM3544
Power	5V	ISO_5V
Ground/common	GND	ISO_COM
Input		
Description	3540	RM3544
TRIG (measurement start)	TRIG	TRIG
Manual mode	MANU	-
Range setting	RANGE	-
Zero adjustment	0ADJ	0ADJ
Printer output	PRINT	PRINT
Table/panel	COMP0 to 3	LOAD0 to 4
BCD low-order byte output*	-	BCD_LOW
Key lock	-	KEY_LOCK
General-purpose input	-	IN

Output		
Description	3540	RM3544
Comparator Hi	Hi	HI
Comparator IN	IN	IN
Comparator Lo	Lo	LO
Comparator HiLo	-	HILO
Measurement current error	CCERR	ERR
Measurement complete	EOC	EOM
Analog measurement complete	-	INDEX
Range data output	DPO to 2	RNG_OUT0 to 3
BCD output *	BCD (digit 10 ³) – bit 3	BCD5-3
	BCD (digit 10 ³) – bit 2	BCD5-2
	BCD (digit 10 ³) – bit 1	BCD5-1
	BCD (digit 10 ³) – bit 0	BCD5-0
	BCD (digit 10 ²) – bit 3	BCD4-3
	BCD (digit 10 ²) – bit 2	BCD4-2
	BCD (digit 10 ²) – bit 1	BCD4-1
	BCD (digit 10 ²) – bit 0	BCD4-0
	BCD (digit 10 ¹) – bit 3	BCD3-3
	BCD (digit 10 ¹) – bit 2	BCD3-2
	BCD (digit 10 ¹) – bit 1	BCD3-1
	BCD (digit 10 ¹) – bit 0	BCD3-0
	BCD (digit 10 ⁰) – bit 3	BCD2-3
	BCD (digit 10 ⁰) – bit 2	BCD2-2
	BCD (digit 10 ⁰) – bit 1	BCD2-1
	BCD (digit 10 ⁰) – bit 0	BCD2-0
	-	BCD1-3
	-	BCD1-2
	-	BCD1-1
	-	BCD1-0
General-purpose output	-	OUT0 to 2

* BCDm-n: Outputs the nth bit of digit m. (BCD1-x is the lowermost digit, while BCDx-0 is the LSB.)

The 3540's external connector (BCD, CCERR, and ECO signals) generates TTL output, but the RM3544 generates all open-collector output.

(4) BCD and DP (RNG_OUT) signals

When only using the uppermost four digits as with the 3540, use the instrument with the BCD_LOW signal set to off. To acquire the first digit of the measured value and range information, it is necessary to control the BCD_LOW signal.

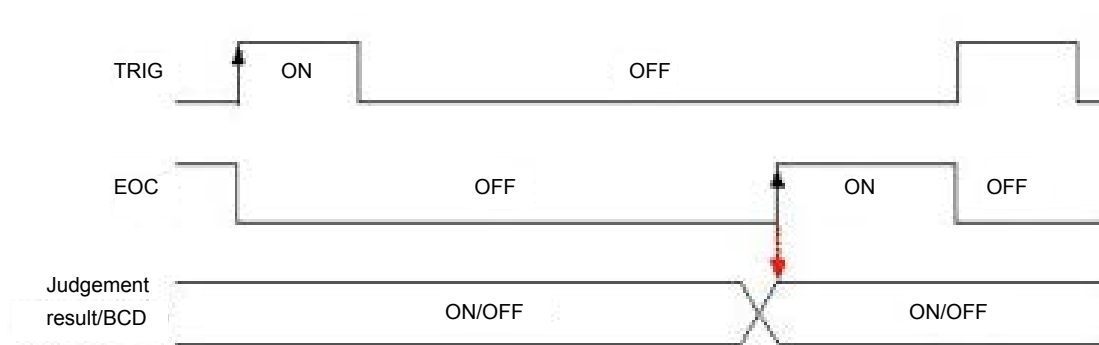
(5) Measurement range setting

The RM3544 does not have a range setting signal. Instead, you should save range information on each panel and then switch ranges using the panel load function. (For example, PANEL1: 30 mΩ range, PANEL2: 300 mΩ range)

(6) Acquiring judgment results

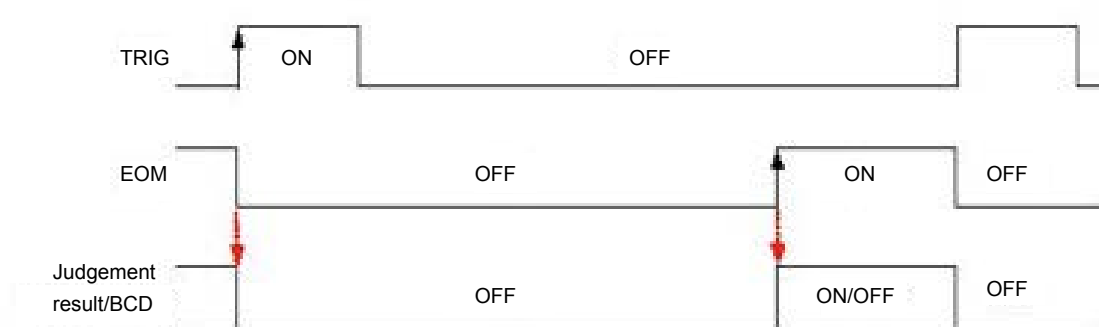
The RM3544 does not provide any functionality that corresponds to the 3540's manual comparator function (MANU signal). The judgment result and BCD signals are cleared at different times on the two instruments. As with the 3540's EOC signal, judgment results should be acquired while the RM3544's EOM signal is on.

3540: Hold state timing chart



- When the EOC signal turns on, the judgment result and BCD signals change.

RM3544: Timing chart when using the external trigger [EXT] setting



- When the TRIG signal turns on, the judgment result and BCD signals are cleared.
- When the EOM signal turns on, the judgment result and BCD signals change

4. Commands

Most 3540 commands can be used with the RM3544, but some must be changed due to differences in display resolution and other aspects of instrument operation. Be sure to read over the following before using 3540 commands with the RM3544.

(1) Command correspondence chart

- Set the number of measurement digits to 4 to accommodate the 3540.
- If replacing 3540 commands with RM3544 commands, see the corresponding commands.

RM3544 Command	Operation when using 3540 commands and associated operating precautions	Corresponding RM3544 command
RESET	<p>This command changes the instrument to the settings listed below. It configures the instrument to reflect the 3540's initial state. Please note that the resulting reset operation differs from a normal reset.</p> <ul style="list-style-type: none"> ◦ Number of measurement digits setting: 4 digits ◦ Measurement range: 30 mΩ range ◦ Measurement speed: Slow ◦ Trigger source: Internal trigger ◦ Comparator: Off ◦ Comparator mode: ABS ◦ Comparator upper and lower limits: 0 ◦ Judgment tone (Hi, IN, Lo): Off ◦ Temperature correction function (TC): Off ◦ Zero-adjustment data: Off ◦ Line frequency: Auto 	<p>*RST</p> <p>*This command differs from RST as follows:</p> <ul style="list-style-type: none"> ◦ Auto-range operation: On ◦ Number of measurement digits setting: 5 digits
RMES	<ul style="list-style-type: none"> ◦ This command configures the number of measurement digits setting to reflect the 3540's setting of 4 digits. The response will indicate the number of digits selected with the number of measurement digits setting. ◦ If the measured value is negative, it will begin with a minus sign (-) rather than a space. Example: If the display indicates -20.00 mΩ, the response will be -20.00E-03. If the display indicates -2.00 mΩ, the response will be -2.00E-03. ◦ If the comparator is set to REF%, the following formula is used as with the 3540, yielding a value that differs from the display: Absolute value = Measured value / Reference value × 100 [%] 	<p>:FETCh?</p> <p>In the response, digits that are not displayed due to the number of measured digits setting are replaced with the numeral 0.</p>
TMES	This command can be used just as with the 3540.	:FETCh:TEMPerature?
TRG	<p>This command produces the following operation, depending on the trigger source setting:</p> <ul style="list-style-type: none"> ◦ Internal trigger Returns the current measured value. ◦ External trigger Applies the trigger and returns the measured value after measurement completes. <p>The response will be the same as the RMES command.</p>	<ul style="list-style-type: none"> ◦ When acquiring the most recent measured value :FETCh? ◦ When applying the trigger by command and acquiring the measured value :READ?
EOC	This command can be used just as with the 3540.	Use the event status register.
ADJ	<p>This command can be used just as with the 3540.</p> <p>For more information about the zero-adjustment range, see the User Manual. If zero-adjustment results in a warning and then execution completes, the response will be "OK."</p>	:ADJust?
FUNC	The RM3544 does not provide this function, but the command will always yield a response of "OK."	

RM3544 Command	Operation when using 3540 commands and associated operating precautions	Corresponding RM3544 command
RNG	This command makes the following setting depending on the data portion: 0:30mΩ range 1:300mΩ range 2:3Ω range 3:30Ω range 4:300Ω range 5:3kΩrange 6:30kΩrange Calling the RNG command after the CHI or CLO command causes the comparator setting value to be converted to a resistance value based on the RNG command's range.	:SENSe:RESistance:RANGe
SMP	This command makes the following setting depending on the data portion: 0: Sets the measurement speed to slow. 1: Sets the measurement speed to fast.	:SAMPlE:RATE
HZ	This command can be used in the same manner as on the 3540. However, the RM3544 provides an automatic frequency detection function, and it is recommended to use that function.	:SYSTem:LFRequency
HOLD	The RM3544's trigger source setting provides functionality equivalent to the 3540's hold setting. This command makes the following setting depending on the data portion: 0: Internal trigger 1: External trigger	When inputting the trigger signal using EXT I/O :TRIGger:SOURce When applying the trigger with a command :INITiate:CONTinuous
AUTO	This command can be used in the same manner as on the 3540. However, specifying auto-range operation when the comparator function is on will result in an execution error.	:SENSe:RESistance:RANGe:AUTO
TC	This command can be used in the same manner as on the 3540.	:CALCulate:TCORrect:STATe
COMP	This command can be used in the same manner as on the 3540. Turning on the comparator function during auto-range operation will cause auto-range operation to be canceled.	:CALCulate:LIMit:STATe
CNO	This command is invalid and will result in a command error.	
CMD	This command makes the following setting depending on the data portion: 0:ABS mode 1:REF% mode It can be executed even when the comparator is off and will not result in an execution error.	:CALCulate:LIMit:MODE
BUZ	This command makes the following setting depending on the data portion: 0: Turns all judgment tones off. 1: Turns the judgment tone for IN to off, for Hi and Lo to on, and for type 2 to 2 tones. 2: Turns the judgment tone for IN to on, for type 2 to 2 tones, and for Hi and Lo to off.	:CALCulate:LIMit:BEEPer
CHI	This command converts the count value in the data portion to a resistance value based on the current range and sets it. Calling the RNG command after the CHI command converts the value to a resistance value based on the RNG command's range and sets it. It can be executed even when the comparator is off and will not result in an execution error.	:CALCulate:LIMit:UPPer :CALCulate:LIMit:LOWer

RM3544 Command	Operation when using 3540 commands and associated operating precautions	Corresponding RM3544 command
CLO	This command converts the count value in the data portion to a resistance value based on the current range and sets it. Calling the RNG command after the CLO command converts the value to a resistance value based on the RNG command's range and sets it. It can be executed even when the comparator is off and will not result in an execution error.	:CALCulate:LIMit:REFeRence :CALCulate:LIMit:PERCent
CCC	This command is invalid and will result in a command error.	
LOCK	This command can be used in the same manner as on the 3540.	:SYSTem:KLOCk

(2) Measured value format comparison chart

The plus sign for measured values has been replaced with the space character (ASCII code 20h).

Resistance measured values

3540 (RMES command)				
Range	Measured values	OF	Current fault	TC error
30.00 mΩ	+000.00E-03	OF	CC ERR	BAD DATA
300.0 mΩ	+000.0E-03	OF	CC ERR	BAD DATA
3.000 Ω	+0.000E-00	OF	CC ERR	BAD DATA
30.00 Ω	+00.00E-00	OF	CC ERR	BAD DATA
300.0 Ω	+000.0E-00	OF	CC ERR	BAD DATA
3.000 kΩ	+0.000E+03	OF	CC ERR	BAD DATA
30.00 kΩ	+00.00E+03	OF	CC ERR	BAD DATA

RM3544			
Range	Measured values *	±OvrRng	Measurement fault
30.000 mΩ	±00.000E-03	±10.000E+19	+10.000E+29
300.00 mΩ	±000.00E-03	±100.00E+18	+100.00E+28
3.0000 Ω	±0.0000E+00	±1.0000E+20	+1.0000E+30
30.000 Ω	±00.000E+00	±10.000E+19	+10.000E+29
300.00 Ω	±000.00E+00	±100.00E+18	+100.00E+28
3.0000 kΩ	±0.0000E+03	±1.0000E+20	+1.0000E+30
30.000 kΩ	±00.000E+03	±10.000E+19	+10.000E+29
300.00 kΩ	±000.00E+03	±100.00E+18	+100.00E+28
3.0000 MΩ	±0.0000E+06	±1.0000E+20	+1.0000E+30

Comparator REF% mode

3540 (RMES command)				
	Measured values	OF	Current fault	TC error
	000.0	OF	CC ERR	BAD DATA

RM3544			
	Measured values	±OvrRng	Measurement fault
	±000.00E+00	±100.00E+18	+100.00E+28

Temperature measured values

3540 (TMES command)				
	Measured values	OF		
	+00.0	OF		

RM3544			
	Measured values	±OvrRng	Measurement fault
	±00.0 E+00	±10.0E+19	±10.0E+20



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