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RL101

Below-the-Hook Scale
Serial Protocol

Technical Manual



RICE LAKE®
WEIGHING SYSTEMS

October 20, 2023

PN 220244 Rev A

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www.ricelake.com

Revision History

This section tracks and describes manual revisions for awareness of major updates.

Revision	Date	Description
A	October 20, 2023	Initial manual release

Table i. Revision Letter History

Technical training seminars are available through Rice Lake Weighing Systems. Course descriptions and dates can be viewed at www.ricelake.com/training or obtained by calling 715-234-9171 and asking for the training department.

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1.0 Introduction

This manual describes the available serial protocol commands for the RL101 below-the-hook scale. The RL101 scale is a *lift and weigh* device, refer to Safety and Periodic Maintenance Manual (PN 153105) fore more information.

Manuals are available from Rice Lake Weighing Systems at www.ricelake.com/manuals

Warranty information is available at www.ricelake.com/warranties

1.1 Serial Command Format

The serial protocol commands are described in the following typographical conventions:

Description	Reads RL101 model and firmware version						
Notes	Special notes, if needed						
Format	C	M	D	X			
Where	X Description of the command parameters, if present						
Answer	A	N	S	W	X	X	
Where	X X Description of the answer values, if present						

Example								
	Command	C	M	D	1	Example of a specific command		
	Answer	A	N	S	W	1	2	Answer to the specific command

The format of commands is composed of:

- Capital characters - compulsory characters
- Lower case characters - parameters of the command/answer
- Characters in square brackets ([x]) - optional characters

Command terminator characters:

All commands and answers terminate with carriage return (CR) (decimal 13, hexadecimal 0D) or line feed (LF) (decimal 10, hexadecimal 0A) characters.

A command and answer following the convention above consist of:

Command CMD1<CR><LF>
Answer ANSW12<CR><LF>

Command	ASCII	C	M	D	1	<CR>	<LF>		
	Decimal	67	77	68	49	13	10		
	Hexadecimal	43	4D	44	31	0D	0A		
Answer	ASCII	A	N	S	W	1	2	<CR>	<LF>
	Decimal	65	78	83	87	49	50	13	10
	Hexadecimal	41	4e	53	57	31	32	0D	0A

NOTE: Terminators are omitted from the remaining examples in the manual.

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1.2 Command Errors

Typically most successfully executed commands have an answer. If a received command is not recognized or has a wrong format, an error answer is sent from the scale. The following lists error answers:

Answer							Description
E	R	R	0	1	<CR>	<LF>	Command format wrong
E	R	R	0	2	<CR>	<LF>	Command parameters error
E	R	R	0	3	<CR>	<LF>	Command not allowed in the scale state
E	R	R	0	4	<CR>	<LF>	Command not recognized error
E	R	R	0	5	<CR>	<LF>	There has been an error in the response of the indicator.
E	R	R	0	6	<CR>	<LF>	Checksum error

2.0 Commands

This chapters discusses RL101 serial commands.

2.1 VER - RL101 version

Description	Reads RL101 model and firmware version															
Format	V	E	R													
Answer	V	E	R	,	r	[r]	s	s	,	m	m	m	m	m	m	m	m
Where	r[r] Firmware major release in decimal value															
	ss Firmware minor release															
	m...m Model name in 8 characters															

Example	RL101 release 1.00 connected s												
	Command	V	E	R									
	Answer	V	E	R	,	1	0	0	,	D	F	W	0	6

2.2 READ - Weight Read Command

Description	Reads the scale weight			
Format	R	E	A	D
Answer	STANDARD STRING (see Section 3.0 on page 21).			

2.3 REXT - Weight Read Command

Description	Reads the scale weight			
Format	R	E	X	T
Answer	EXTENDED STRING (see Section 3.0 on page 21).			

2.4 REXD - Weight Read Command with Date and Time

Description	Reads the scale weight with date and time			
Format	R	E	X	D
Answer	EXTENDED STRING (see Section 3.0 on page 21).			

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2.5 GR10- Weight Read Command In High Resolution

Description	Reads net weight in high resolution						
Note	The weight has 1 more decimal than the RL101 displays had digits						
Format	G	R	1	0	[x]		
Where	x	E to enable compatibility mode of the REXT command with the old version 03.05. When enabled, weights are formatted with 8 digits instead of digits (as in new version). D to disable compatibility mode. Disables the compatibility of the REXT command with the old version 03.05 (default).					

Answer	x present				O	K																
	x omitted	Compatibility mode disabled																				
		s	s	,	G	X	,	w	w	w	w	w	w	w	w	w	w	,	u	u		
		Compatibility mode enabled																				
		s	s	,	c	,	w	w	w	w	w	w	w	w	w	w	u	u				
Where	ss		T	L	Tilt condition error																	
			O	L	Over load condition																	
			U	L	Under load condition																	
			S	T	Weight stable																	
			U	S	Weight unstable																	
	c	Selected scale (always 1)																				
	w...w	Net weight in high resolution on 10 characters with decimal point padded in front with blank spaces																				
	uu	Unit of measure (“ g”, “kg”, “ t”, “lb”)																				

Example 1	Enables compatibility mode																					
	Command	G	R	1	0	E																
	Answer	O	K																			
Example 2	Weight in high resolution with compatibility mode disabled																					
	Command	G	R	1	0																	
	Answer	S	T	,	G	X	,				1	.	0	0	0	0	,	k	g			
Example 3	Weight in high resolution with compatibility mode enabled																					
	Command	G	R	1	0																	
	Answer	S	T	,	1	,					1	.	0	0	0	0	k	g				

2.6 MVOL – Microvolts Read Command

Description	Reads microvolts relative to the weight				
Format	M	V	O	L	
Answer	STANDARD STRING (see Section 3.0 on page 21).				

2.7 T - Semi Automatic Tare

Description	Semi automatic tare function	
Format	T	
Answer	STANDARD STRING (see Section 3.0 on page 21).	

Example	Command	T	
	Answer	No answer	

2.8 TARE - Semi Automatic Tare

Description	Semi automatic tare function				
Format	T	A	R	E	
Answer	O	K			

Example	Command	T	A	R	E		
	Answer	O	K				

2.9 TMAN - Preset Tare

Description	Preset tare function											
Format	T	M	A	N	t	t	t	t	t	t	t	t
Where	t...t			Tare to set with decimal point (up to 8 characters)								
Answer	O	K	***NOTE: OK, doest not indicate the RL101 executes the tare.***									

Example 1	Sets a preset tare equal to 1.5 lb								
	Command	T	M	A	N	1	.	5	
	Answer	O	K						
Example 2	Sets a preset tare equal to 10 kg								
	Command	T	M	A	N	1	0		
	Answer	O	K						

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2.10 Z - Zero Scale

Description	Zeros scale function
Format	Z
Answer	No answer

Example	Command	Z
	Answer	No answer

2.11 ZERO - Zero Scale

Description	Zeros scale function				
Format	Z	E	R	O	
Answer	O	K			

Example	Command	Z	E	R	O	
	Answer	O	K			

2.12 C - CLEAR Key

Description	Simulates pressing the CLEAR key
Format	C
Answer	No answer

Example	Command	C
	Answer	No answer

2.13 CLEAR - CLEAR Key

Description	Simulates pressing he CLEAR key				
Format	C	L	E	A	
Answer	O	K			

Example	Command	C	L	E	A	R	
	Answer	O	K				

2.14 ECHO - Echoes Received Characters

Description	Echoes received characters
Format	E C H O [c ... c]
Where	c...c Arbitrary characters
Answer	E C H O c ... c
Where	c...c Same characters of the received command

Example	Command	E	C	H	O	A	B	C	D	
	Answer	E	C	H	O	A	B	C	D	

2.15 ALIM - Reads Power Supply and Battery Levels

Description	Reads power supply and battery levels			
Format	A L I M			
Where	N: character 'N'. If present, the command answer will have millivolt values.			
Answer	P W : x ... x B T : y ... y			
Where	x...x Decimal value			
	y...y Decimal value			
		ALIM		**ALIMN**
		Description	Values	Description	Range
	x...x	Power supply connection	0: power supply disconnected 1: power supply connected	Power supply voltage in millivolt	>= 0
	y...y	Battery value	0 ~ 9 0: discharged 9: charged	Battery voltage in millivolt	>= 0

Example 1	Command	A	L	I	M														
	Answer	P	W	:		1		B	T	:		6							
Example 2	Command	A	L	I	M	N													
	Answer	P	W	:		1	2	9	2	0		B	T	:		6	5	0	1

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2.16 RAZF - ADC value

Description	Retrieves the ADC value of the selected RL101 channel
Answer	RL101 response in “IND.CH.” mode: STANDARD STRING (see Section 3.0 on page 21). RL101 response in “DEP.CH.” mode: see the answer in Section 2.17 on page 12.

2.17 RAZM - ADC Value

Description	Retrieves the ADC value of all channels																			
Format	R	A	Z	M																
Answer	Independent channels working mode																			
	s	s	,	R	Z	,	d	d	d	d	d	d	d	d	d	d	,	v	v	
Where	Dependent channels working																			
	R	Z	,	v^1	v^1	v^1	v^1	v^1	v^1	v^1	v^1	v^1	v^1	,	v^2	v^2	v^2	v^2	v^2	v^2	v^2
	v^2	v^2	v^2	,	v^3	v^3	v^3	v^3	v^3	v^3	v^3	v^3	v^3	v^3	,	v^4	v^4	v^4	v^4	v^4	v^4
	v^4	v^4	v^4	v^4	,	v	v													
	ss		T	L	Tilt condition error															
			O	L	Overload condition															
			U	L	Underload condition															
			S	T	Weight stable															
			U	S	Weight unstable															
	d...d		ADC value on 10 characters padded on front with blank spaces																	
	v_i... v_i		ADC value of the i-th channel in dependent channels working mode																	

Example 1	ADC voltage value equal to 450000 in independent channels working																			
	Command	R	A	Z	M															
	Answer	S	T	,	R	Z	,					4	5	0	0	0	0	,	v	v
Example 2	Reading the 2 configured channels’ ADC values (in dependent channels working mode), 1st channel ADC value = 15000, 2nd channel ADC value = 20000																			
	Command	M	V	O	L															
	Answer	R	Z	,							1	0	0	0	,					
			2	0	0	0	,	v	v											

2.18 STPT - Setpoint Setting

Description	Setpoint setting		
Note	The transmitted values are valid until the indicator is turned off. To permanently save these values on the RL101, use the CMDSAV command (see Section 2.22 on page 14). To save various setpoints, set all of them and at the end transmit the save command (CMDSAV).		
Format	S T P T n t x x x x x x t y y y y y y		
Where	n	Index of the digital output related to the setpoint format (0÷3) 0 to set the setpoint 1, 3 to set setpoint 4	
	t	O	The following value is setpoint one on
		F	The following value is setpoint one off
	x...x y...y	Setpoint weight values in decimal format with no decimals on up to 6 digits. If the scale has 3 decimals and the setpoint value is to be set equal 1.000 kg, set xxxx (or yyyy) equal to 1000	
	NOTE: If setpoint hysteresis is disabled, the off value is ignored but must be less than the on value.		
Answer	O K		

Example	Sets the on value of the 2nd setpoint equal to 2.000 kg and the off value equal to 1.900 kg in a scale calibrated with 3 decimals																
	Command	S	T	P	T	1	0	2	0	0	0	F	1	9	0	0	
	Answer	O	K														

2.19 TATO - Sets activation, target and tolerance

Description	Sets activation, target and tolerance
Note	Only by the tolerance Check mode. The transmitted values are valid until the indicator is turned off. To permanently save these on the RL101, use the CMDSAV command (see Section 2.22 on page 14). If the “KKKKK” tolerance is omitted, the “ZZZZZZ” tolerance is considered as both the lower and the upper.

Format	T	A	T	O	,	X	X	X	X	X	X	,	Y	Y	Y	Y	Y	Y	,
	Z	Z	Z	Z	Z	Z	,	K	K	K	K	K	K						
Where	XXXXXX	The activation threshold without decimal point																	
	YYYYYY	The target weight without decimal point																	
	ZZZZZZ	The lower tolerance without the decimal point																	
	KKKKK	The upper tolerance without the decimal point																	
Answer	O	K																	

Example	Setting the activation equal to 0.020 kg, target equal to 2.000 and tolerances equal to 0.100																			
	T	A	T	O	,		0	.	0	2	0	,		2	.	0	0	0	,	
		0	.	1	0	0	,		0	.	1	0	0							

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2.20 TLCK - Tare Function Status

Description	Tare function status					
Format	T	L	C	K		
Answer	T	L	C	K	e	
Where	e E Tare locked D Tare unlocked					

Example	Tare disabled						
	Command	T	L	C	K		
	Answer	T	L	C	K	D	

2.21 TLCKe - Tare Function Programming

Description	Programs the tare function					
Note	The transmitted values are valid until the indicator is turned off. To permanently save the values on the RL101, use the CMDSAV command (see Section 2.22 on page 14).					
Format	T	L	C	K	e	
Where	e E To lock the tare D To unlock the tare					
Answer	O	K				

Example	Tare locked						
	Command	T	L	C	K	D	
	Answer	O	K				

2.22 CMDSAVE - Data Saving Command

Description	Saves data						
Format	C	M	D	S	A	V	E
Answer	O	K					

Example	Saving data								
	Command	C	M	D	S	A	V	E	
	Answer	O	K						

2.23 NTGS – NET / GROSS Switch

Description	Switches the main weight display value from gross to net and net to gross				
Note	The command is executed only if one is in the “Net / Gross switch” functioning mode, F .ModE >> Funct = ntGS.				
Format	N	T	G	S	
Answer	O	K			

Example	Command	N	T	G	S	
	Answer	O	K			

2.24 PRNT - Simple Print Function

Description	Executes the simple print function				
Format	P	R	N	T	
Answer	O	K			

Example	Command	P	R	N	T	
	Answer	O	K			

2.25 DISP - Displays a Message

Description	Displays a message on the display								
Note	The message is displayed for the interval of time set with the DINT command (Section 2.26 on page 16). When the message in the command is a numeric type (for example the 00), and the transmitted message has two consecutive points, the message is stops after the first of the two points. When the display shows a message transmitted serially with the DISP command, the indicator does not display messages usually shown in the scale status (ZERO, TARE, HOLD, etc..).								
Format	D	I	S	P	0	0	c	...	c
Where	c...c Message to display								
Answer	O	K							

Example	Displays the message “- OK -” on the display													
	Command	D	I	S	P	0	0	-		O	K		-	
	Answer	O	K											

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2.26 DINT - DISP Command Interval

Description	Sets the time interval the message displays with the DISP command								
Note	Value 0 sets an infinite interval.								
Format	D	I	N	T	t	t	t	t	
Where	tttt Message interval time in milliseconds expressed in hexadecimal format								
Answer	O	K							

Example	Sets the message interval time to 1 second (1000 ms, 03E8 hex)								
	Command	D	I	N	T	0	3	E	8
	Answer	O	K						

2.27 PCOK - PC Confirmation Command

Description	PC confirmation command, the indicator displays “-PCOK-” for about 2 seconds.				
Format	P	C	O	K	
Answer	O	K			

Example	Command	P	R	O	K	
	Answer	O	K			

2.28 SPMU - Average Piece Weight Setting

Description	Sets the average piece weight (APW) in the set AVG unit							
Note	Only for the counting operating mode. Average piece weights are not accepted in the SPMU.12<CRLF> format, these must be in the SPMU0.12<CRLF> format. The APW are not accepted equal to zero.							
Format	S	P	M	U	x	...	x	
Where	x...x Average piece weight value with decimal point on up to 8 characters							
Answer	O	K						

Example	Sets an average piece value equal to 10.5									
	Command	S	P	M	U	1	0	.	5	
	Answer	O	K							

2.29 STAT - Reads RL101 Status

Description	Reads the RL101 status						
Format	S	T	A	T			
Answer	S	T	A	T	x	x	
Where	xx Status index in decimal format (see Section Table 2-1.)						

Example	RL101 in the state							
	Command	S	T	A	T			
	Answer	S	T	A	T	0	1	

Index	State
00	Normal scale status
01	Normal scale status in input
02	RL101 in technical setup phase
03	RL101 in boot phase
04	RL101 in receive/transmit setup phase
05	RL101 in test phase of the serial ports
06	RL101 in print test

Table 2-1. RL101 Status

2.30 KEYP - Simulates Pressing a Key

Description	Simulates pressing a key/button						
Note	In case the simulated key has two linked functions (key briefly pressed or at length, like the TARE key), if the KEYP command is followed by the release command of the (KEYR) key within a maximum time of 1.5 seconds, the quick function will be executed (key briefly pressed). Otherwise, the second function will be made (key pressed at length).						
Format	K	E	Y	P	x	x	
Where	xx Key code in hexadecimal format (see Section Table 2-2.)						
Answer	O	K					

Example	Simulates pressing the ZERO key							
	Command	K	E	Y	P	0	4	
	Answer	O	K					

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Key code	Key
00	MODE key;
01	F key
02	ENTER key
03	TARE key
04	ZERO key
05	0 key
06	1 key
07	2 key
08	3 key
09	4 key
0A	5 key
0B	6 key
0C	7 key
0D	8 key
0E	9 key
0F	INFO key
10	C key

Table 2-2. Key Press Hexadecimal Codes

2.31 KEYR - Simulates Releasing a Key

Description	Simulates releasing a key. This command typically follows the key press command (KEYP).				
Format	K	E	Y	R	
Answer	O	K			

Example	Command	K	E	Y	R	
	Answer	O	K			

2.32 KEYE - Keyboard Status

Description	Keyboard status					
Format	K	E	Y	E		
Answer	K	E	Y	E	e	
Where	e E the keyboard is enabled D the keyboard is disabled					

Example	Keyboard disable						
	Command	K	E	Y	E		
	Answer	K	E	Y	E	D	

2.33 KEYEe - Enables/Disables Keyboard

Description	Enables/disables the Keyboard					
Note	The transmitted values are valid until the indicator is turned off. To permanently save these values on the RL101, use the CMDSAV command (see Section 2.22 on page 14)E).					
Format	K	E	Y	E	e	
Where	e E to enable the keyboard D to disable the keyboard					
Answer	O	K				

Example	Keyboard disable						
	Command	K	E	Y	E	D	
	Answer	O	K				

2.34 RALL - Reads Scale Data

Description	Reads all scale data				
Format	R	A	L	L	

Answer	s	s	,	c	,	n	n	n	n	n	n	n	u	u	,	g	g	g	g	g	g	g	u	u
	,	p	p	t	t	t	t	t	t	t	u	u	,	t_n	t_n	t_n	t_n	t_n	t_n	t_n	u_n	u_n	,	s_s
	s_s	s_s	,	c_k	c_k	c_k	,	k	k	k	,	n	n	n	,	r	r	r	r	r	-	d	d	d
	d	d	d																					

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Where	ss	T	L	Tilt condition error
		O	L	Overload condition
		U	L	Underload condition
		S	T	Weight stable
		U	S	Weight unstable
	c	Number of scales (always 1)		
	n...n	Net weight in 7 characters		
	uu	Unit of measure (“ g”, “kg”, “ t”, “lb”)		
	g...g	Gross weight in 7 characters		
	uu	Unit of measure (“ g”, “kg”, “ t”, “lb”)		
	pp	Tare type (“ ” with semi-automatic tare, “PT” with preset tare)		
	t...t	Tare value in 7 characters		
	uu	Unit of measure (“ g”, “kg”, “ t”, “lb”)		
	$t_n...t_n$	Last totalization net weight in 7 characters		
	u_tu_t	Last totalization unit of measure (“ g”, “kg”, “ t”, “lb”)		
	$s_ss_ss_s$	Scale state, decimal value on 3 digits padded with zeros on front • 000 weighing • 001 numeric value input • 002 set-up menu		
	$c_kc_kc_k$	Pressed keys counter, decimal value on 3 digits padded with zeros on front (*)		
	kkk	Pressed key code, decimal value on 3 digits padded with zeros on front		
	nnn	Number of totalizations, decimal value on 3 digits padded with zeros on front		
	r...r	Alibi rewrite ID value on 5 digits padded with zeros on front		
		Alibi ID value on 6 digits padded with zeros in front		

Example	Last totalization net is 3.500 lb																						
	Command						R	A	L	L													
	Answer																						
	S	T	,	1	,			3	.	5	0	0	k	g	,			5	.	0	0	0	l	b
	,	P	T			1	.	5	0	0	l	b	,			3	.	5	0	0	l	b	,	
		1	,	0	1	5	,	0	5	5	,	0	0	3	,	0	0	0	0	0	-	0	0	0
	0	0	2																				

3.0 Communication Strings

3.1 Short String

01ST,GS, 0.0,lb<CR><LF>

Where:

01	Code 485 of the instrument (2 characters), only if communication mode 485 is enabled
ST	Scale status (2 characters): US - Weight unstable ST - Weight stable OL - Weight overload (out of range) UL - Weight underload (out of range) TL - Scale not level (inclinometer active)
,	ASCII 044 character
GS	Type of weight data (2 characters)
,	ASCII 044 character
0.0	Weight (8 characters including the decimal point)
,	ASCII 044 character
lb	Unit of measurement (2 characters)
<CR><LF>	Transmission terminator, characters ASCII 013 and ASCII 010

3.2 Extended String

011,ST, 0.0,PT 20.8, 0,lb<CR><LF>

Where:

01	Code 485 of the instrument (2 characters), only if communication mode 485 is enabled
1	ASCII 049 character
,	ASCII 044 character
ST	Scale status (2 characters): US - Weight unstable ST - Weight stable OL - Weight overload (out of range) UL - Weight underload (out of range) TL - Scale not level (inclinometer active)
,	ASCII 044 character
0.0	Net weight (10 characters including the decimal point)
,	ASCII 044 character
PT	Indication of preset manual tare (2 characters)
20.8	Tare weight (10 characters including the decimal point)
,	ASCII 044 character
0	Number of pieces (10 characters)
,	ASCII 044 character
lb	Unit of measurement (2 characters)
<CR><LF>	Transmission terminator, characters ASCII 013 and ASCII 010

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