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## Model 2302/2302-PJ/2306/2306-PJ Battery/Charger Simulator

### Packing List

## FAST, SEARCh, and DETect

This document provides information on Keithley's Model 2302/2302-PJ/2306/2306-PJ Battery/Charger Simulators. FAST, SEARCh, and DETect capabilities have been added for Pulse Current Measurements along with a user set pulse current timeout. These features are available in Firmware Revision B05 and later (use the REVISION NUMBER menu item located on the main menu to display the firmware revision). The new pulse current FAST, SEARCh, and DETect capabilities described in this addendum are bus only features (the settings are ignored when operating the power supply in local mode — front panel) while the new variable pulse current timeout feature can be accessed over the bus or from the front panel and used in local or remote mode. This addendum provides information on using these new features.

### New features

#### Front panel

The front panel can be used to set the new variable pulse current timeout feature. The menu item is located in the PULSE CURRENT menu after the AUTO TIME menu item as shown in Table 2. Refer to "Using FAST, SEARCh, and DETect" later in this addendum for detailed usage information on properly setting this TimeOUT variable.

*NOTE Pulse Current #1/#2, and Integration time settings (High, Low, Average, and Auto) are contained in Table 1 for reference of the PULSE TIMEOUT menu item only — no change to these menu items has occurred.*

Table 1  
**Front panel menu item — Pulse Current Timeout**

Menu item	Description	Reference
PULSE CURRENT #1/#2	Pulse current configuration.	Section 3 of the 2302/2306 Instruction Manual
HIGH TIME	Set high time integration rate (in $\mu$ sec.).	
LOW TIME	Set low time integration rate (in $\mu$ sec.).	
AVERAGE TIME	Set average time integration rate (in $\mu$ sec.).	
AUTO TIME	Set pulse integration rates automatically.	
<b>PULSE TIMEOUT</b>	<b>Set pulse timeout (default is 1.000 seconds, incremented in 1ms steps).</b>	<b>This document</b>

## Bus commands

Table 2 contains the new bus commands.

Table 2

### New bus commands (Firmware B05 and later)

Commands	Description	Default
SENSe[1] :PCURrent :FAST :SEARCh :DETECT :TimeOUT	SENSe subsystem for Channel #1 (battery channel): Pulse current configuration: Enable or disable pulse current fast readings. Enable or disable pulse current search. Enable or disable pulse current detection mode. Specify length of timeout: 5ms -1000ms (1 second) incrementing in 1ms.	OFF ON OFF 1 (sec)
SENSe2 :PCURrent :FAST :SEARCh :DETECT :TimeOUT	SENSe subsystem for Channel #2 (charger channel): Pulse current configuration: Enable or disable pulse current fast readings. Enable or disable pulse current search. Enable or disable pulse current detection mode. Specify length of timeout: 5ms -1000ms (1 second) incrementing in 1ms.	OFF ON OFF 1 (sec)

## Command notes

SENSe[1]: PulseCURrent:FAST <b>

Applies to battery channel (#1)

SENSe2: PulseCURrent:FAST <b>

Applies to charger channel (#2)

Refer to "Using FAST, SEARCh, and DETect" for detailed usage information.

SENSe[1]:PulseCURrent:SEARCh <b>

Applies to battery channel (#1)

SENSe2: PulseCURrent:SEARCh <b>

Applies to charger channel (#2)

Refer to "Using FAST, SEARCh, and DETect" for detailed usage information.

SENSe[1]: PulseCURrent:DETECT <b>

Applies to battery channel (#1)

SENSe2: PulseCURrent:DETECT <b>

Applies to charger channel (#2)

Refer to "Using FAST, SEARCh, and DETect" for detailed usage information.

SENSe[1]:PulseCURrent:TimeOUT <NRf>

Applies to battery channel (#1)

SENSe2: PulseCURrent: TimeOUT <NRf>

Applies to charger channel (#2)

Refer to "Using FAST, SEARCh, and DETect" for detailed usage information on properly setting the TimeOUT variable.

## Using FAST, SEARCh, and DETect

Use FAST, SEARCh, and DETect to control how background readings are taken. A background reading is a measurement taken by the power supply between user triggered readings. The selected function dictates how background readings are taken between user triggered readings.

For pulse current, a background reading involves looking for the pulse and optionally generating a reading for the user. The various settings of SEARCh, FAST, and DETect allow the user to fine tune the function. This enables the function to perform the desired background readings (if any) between user triggered readings. The default settings (FAST:OFF, SEARCh:ON, and DETect:OFF) allow the pulse current background readings to be taken. If no pulse is present, the setting of TimeOUT affects how responsive the supply is to bus commands. If a pulse is present, the search time affects how responsive the supply is to bus commands (refer to Figure 1). Table 3 contains the available settings for FAST, SEARCh, and DETect commands and a description of the resulting action.

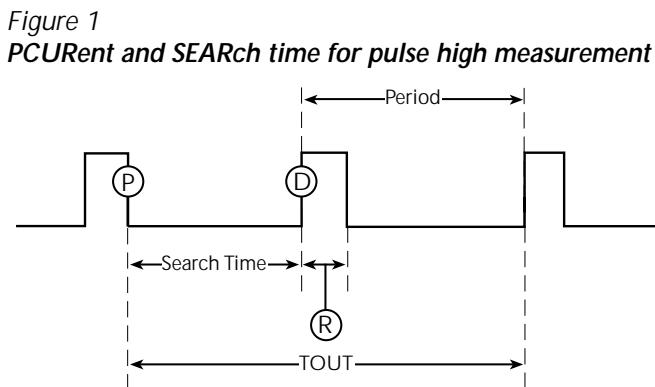
In order to efficiently use FAST, SEARCh, and DETect for pulse current measurements, the user must know the approximate period of the expected pulse. TOUT (TimeOUT) specifies the timeout length for searching for the pulse (default setting is 1 second). When the TOUT value is reached, NO PULSE is displayed (top line of the front panel display) if default settings for FAST, SEARCh, and DETect are used. See Table 3 for what is displayed on the front panel display if the default settings are not used. Set the value for TOUT as follows:

$$\text{TOUT} = \text{Search Time} + \text{Period}$$

Search Time = time allowed for detection of a pulse edge

Period = time between consecutive pulse edges

The timeout value should be set to allow sufficient time for detection of the pulse if the edge is just missed. In Figure 1, (P) is the point where to start looking for the pulse. Since the rising edge was just missed, (D) will be the first detectable rising edge. If the timeout is less than the search time, a pulse trigger timeout (due to TOUT) may occur. Therefore, if the period = 0.4 seconds, a good TOUT value would be 0.5 seconds. A similar method for selecting a TOUT value would be to use a value equal to 105% of the expected pulse period.



TOUT setting must account for Search Time and Period.

(P) = Search for Pulse High edge started

(R) = Reading time taken

(D) = Detected pulse edge (Rising for pulse high measurements)

Search Time: Measured from when unit starts looking for the pulse until the first detectable desired edge. This is a rising edge for HIGH and AVG measurements and the falling edge for LOW measurements.

Period: Time between consecutive pulse edges.

**NOTES** *If a pulse is not present, timeout needs to elapse (TOUT). The TOUT elapsing paces the unit for processing bus commands.*

*If DETECT ON (only), search time needs to elapse before responding to a bus command.*

*If SEARCH OFF or FAST ON, search time and TOUT are not incurred while processing non-user triggered commands (refer to Section 9 of the 2302/2306 Instruction Manual for examples of user triggered commands).*

*Search time or TimeOUT needs to elapse when checking the TLEV command for valid setting if enabled.*

Table 3  
PCURrent FAST, SEARCh, and DETect commands

FAST	SEARCh	DETEct	Description
ON	ON	ON	<p>The unit is most responsive to bus commands in this mode. The supply does not wait for TOUT or search time for background pulse current readings and TLEV command checks. Front panel displays FAST HI / LO / AVG (in remote mode) instead of PCUR HI / LO / AVG (in local mode). The bottom line may show a previous reading or dashes based on what commands were sent before when in remote mode.</p> <p>With FAST set to ON, no pulse detection between user-triggered readings occur, no checking for the parameter of PCUR TLEV commands to detect a pulse occur, no setting of the pulse trigger timeout bits in the status model between user-triggered readings occurs. The front panel has no indication that pulse is not detected. Over the bus, an overflow reading indicates no pulse detected when asked for a user triggered reading.</p> <p>For triggered readings, the PTT (Pulse Trigger Timeout) bit is latched until read so the bit may still be set in the status model from a previous timeout. (See Section 7 of the 2302/2306 Instruction Manual for more information on the status model. For triggered readings, the PTT (Pulse Trigger Timeout) bit will be set if the reading times out and the pulse is not detected.</p>
ON	ON	OFF	
ON	OFF	ON	
ON	OFF	OFF	
<b>Shaded cells designate command with precedence in each mode.</b>			

Table 3 (cont.)  
**PCURrent FAST, SEARCh, and DETect commands**

<b>FAST</b>	<b>SEARCh</b>	<b>DETect</b>	<b>Description</b>
OFF OFF	OFF OFF	ON OFF	<p>The unit is more responsive to bus commands in this mode since the supply does not need to wait for TOUT or search time for pulse current background readings. However, the supply does need to wait for TOUT or search time when checking the parameter setting for TLEV commands. Refer to Figure 1. Front panel displays "NO SEARCH" instead of PULSE HI / LO / AVG. The bottom line may show a previous reading or dashes based on what commands were sent before when in remote mode.</p> <p>The setting of the pulse trigger timeout bits in the status model will only occur between user-triggered readings if TLEV commands are sent. For triggered readings, the PTT (Pulse Trigger Timeout) bit will be set if the reading times out and the pulse is not detected. Also, since the PTT bit is latched until read, the bit may still be set in the status model from a previous timeout. (See Section 7 of the 2302/2306 Instruction Manual for more information on the status model).</p>
OFF	ON	ON	<p>This mode allows the user to know whether the pulse disappeared before a user-triggered reading is requested. The responsiveness of bus commands is governed by TOUT (if no pulses are detected), or by search time (if pulses are detected). Therefore, the longest response time to bus commands is approximately the greater of either TOUT or search time values. Refer to Figure 1.</p> <p>If the pulse is detected, the front panel will display DETECT HI / LO / AV on top line of display. If no pulses are detected, the front panel will display "NO DETECT" as well as the PTT (Pulse Trigger Timeout) bit being set in the status model. Since the PTT bit is latched until read, a query for the PTT bit may indicate that pulse trigger timeout occurred although the display is showing DETECT. (See Section 7 of the 2302/2306 Instruction Manual for more information on the status model). The bottom line may show a previous reading or dashes based on what commands were sent before when in remote mode.</p> <p>Checking for the parameter of PCUR TLEV command may set the PTT bit of the status model. For triggered readings, the PTT (Pulse Trigger Timeout) bit will be set if the reading times out and the pulse is not detected.</p>
<b>Shaded cells designate command with precedence in each mode.</b>			

Table 3 (cont.)

*PCURrent FAST, SEARCh, and DETect commands*

<b>FAST</b>	<b>SEARCh</b>	<b>DETect</b>	<b>Description</b>
OFF	ON	OFF	<p>With DETect OFF, background pulse current measurements will occur between user-triggered readings as well as pulse detection. If the pulse is detected, the front panel will display PULSE HI / LO / AVG on the top line of the display along with the reading on the bottom line. If no pulses are detected, the front panel will display “NO PULSE” as well as the PTT (Pulse Trigger Timeout) bit being set in the status model. Since the PTT bit is latched, a query for the PTT bit may indicate that pulse trigger timeout occurred although the display is displaying PULSE HI / LO / AVG and a reading. (See Section 7 of the 2302/2306 Instruction Manual for more information on the status model). Checking for the parameter of PCUR TLEV commands to detect a pulse may set the PTT bit. If detecting pulses, the supply's responsiveness to bus commands is affected by search time. If not detecting pulses, the supply's responsiveness to bus commands is affected by TOUT. Therefore, the longest response time to bus commands is approximately the greater of either TOUT or search time (refer Figure 1).</p> <p>In this mode, the front panel will show PULSE HI / LO / AVG on the top line with a reading on the bottom. Checking the parameter of PCUR TLEV commands to detect a pulse may set the PTT bit of the status model if the TLEV setting causes no pulse detection. For triggered readings, the PTT (Pulse Trigger Timeout) bit will be set if the reading times out and the pulse is not detected.</p>
<b>Shaded cells designate command with precedence in each mode.</b>			

# New SCPI programming commands

## Common and Signal oriented measurement commands and queries

Three commands were added in firmware version B07 and greater to improve execution speed of the 2306 and 2306-PJ. Table 4 contains descriptions of the added commands.

*NOTE* No short form exists for any of the commands listed in this addendum.

Table 4  
New commands in version B07

Command	Description	Default
BOTHTRG	Triggers a reading on channel 1 and then channel 2. After this command completes, the display is set for Channel #2.	N.A.
BOTHFETCH?	Responds with channel 1 and channel 2 readings in a single message. The message contains a value for channel 1, a comma, and then a value for channel 2. After this command completes, the display is set for Channel #1.	N.A.
BOTHREAD?	Triggers reading on channel 1 and then channel 2, then responds with channel 1 and channel 2 readings in a single message. The message contains a value for channel 1, a comma, and then a value for channel 2. After this command completes, the display is set for Channel #2.	N.A.

## Command notes

When sending either the BOTHTRG or the BOTHREAD? command, make note that the command is applied to channel 1 (battery channel) first and then to channel 2 (charger channel). This allows both channels' triggers to be controlled with a single bus command.

The BOTHTRG, BOTHFETCH?, and BOTHREAD? commands work with the Model 2306 and 2306-PJ, but do not work with the 2302 or the 2302-PJ (i.e., the commands do not work with single channel models).

# Setups — Save, Recall, and Power-on

*NOTE* The output is always off when a memory location is recalled.

For Models 2306-PJ/2302-PJ starting with firmware version B07, setup 3 is unavailable (only setups 0, 1, and 2 are available). Use the \*SAV command to save the present instrument setup configuration in memory for later recall with the \*RCL command. Configure setups using the SAVE SETUP, RECALL SETUP, and POWER ON SETUP items of the MENU (accessed by pressing the MENU key) or over the bus using the following GPIB commands:

**\*SAV <NRf> — save**                      Save present setup in memory  
**\*RCL <NRf> — recall**                      Return to setup stored in memory

Parameters

<NRf> = 0	Memory location 0
1	Memory location 1
2	Memory location 2

**SYSTEM:POSetup <name> — save**      Select power-on setup

Parameters

<name> = RST	Power-up to *RST defaults
SAV0	Power-up to setup stored in memory location 0
SAV1	Power-up to setup stored in memory location 1
SAV2	Power-up to setup stored in memory location 2

Using these commands for setup 3 (such as \*SAV3) will cause a parameter data out of range error.