KEITHLEY

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Model 2302/2302-PJ/2306/2306-PJ
Battery Charger Simulator
B07 and B08 Firmware
Release Notes

Overview

This document provides the latest information for Keithley's Model 2302/2302-PJ/2306/2306-PJ Battery/Charger Simulators. IEEE 488.1 protocol has been added to significantly increase speed over the GPIB. Also, for the Models 2306 and 2306-PJ, trigger on talk for both channels has been added. This function and protocol are available in Firmware B08 and later (use the REVISION NUMBER menu item located on the main menu to display the firmware revision).

Trigger Continuous Mode has also been added for voltage, current, and DVM functions. Trigger Continuous Mode is available in Firmware B08 and later (use the REVISION NUMBER menu item located on the main menu to display the firmware revision).

Three new commands were added in firmware version B07 and higher to improve execution speed of the Models 2306 and 2306-PJ.

GPIB protocol

The Models 2302/2302-PJ/2306/2306-PJ Power Supply supports two GPIB protocols: SCPI and 488.1. The 488.1 protocol significantly increases speed over the GPIB.

When using the 488.1 protocol, throughput is enhanced for data sent to the power supply (command messages) and for data returned by the power supply (response messages). The speed of readings sent over the GPIB is also increased. Factory default is SCPI protocol.

With the 488.1 protocol selected, you will still use SCPI commands to program the power supply. Operation differences between the two protocols are discussed in these release notes.

Selecting the 488.1 protocol

Perform the following steps to select the 488.1 protocol:

> *NOTE:*   *488.1 protocol is a bus only feature—no front panel support.*

When switching between the SCPI and 488.1 protocol, the instrument does not reset. The GPIB protocol setting is saved in EEPROM, and the unit will power up with that selected protocol until changed again.

The GPIB protocol can be changed over the bus. If you use the following query to request the state of MEP, you will know which protocol is enabled:

```
:SYSTem:MEP[:STATe]?
```

If a "1" is returned, MEP is enabled, and the SCPI protocol is selected. A "0" indicates that MEP is disabled, and the 488.1 protocol is enabled. To summarize:

```
1 = SCPI protocol
0 = 488.1 protocol
```

Send the following commands over the GPIB to change the GPIB protocol between SCPI and 488.1:

```
:SYSTem:MEP[:STATe] <1 or ON>        Selects SCPI protocol

:SYSTem:MEP[:STATe] <0 or OFF>       Selects 488.1 protocol
```

The following rules must be adhered to when sending this command with either parameter setting:

1. The command must be the only command on the line or it must be the last command in the command string.
2. No command or query can be after this command on a line going to the power supply.
3. After sending this command allow some time for the instrument to switch into the new mode and be ready for new commands before sending another command or query.

For example, the following command strings are valid:

```
SYST:MEP ON

SENS:NPLC 1.5; :SYST:MEP OFF
```

The following command strings are invalid:

```
SYST:MEP ON; SENS:NPLC?

SYST:MEP OFF; VOLT 2.5
```

Changing the GPIB mode over the bus will clear the blinking R that indicates remote mode operation.

Protocol differences

The following information covers the differences between the 488.1 and SCPI protocols.

Message exchange protocol (MEP)

When the 488.1 protocol is selected, the MEP is disabled to speed up GPIB operation.

The following guidelines/limitations must be followed when using the 488.1 protocol:

1. If a query is sent, it must be the only command on the line or the last of a multiple command line (this limitation also means no multiple queries can be sent). Otherwise, full SCPI command syntax is still supported including long-form and short-form commands, multiple commands, and MIN/MAX/DEF parameter definitions.

   For example, the following command strings are invalid:

   ```
   :SOUR:VOLT?;*OPC?
   :SENS:CURR:RANG?;:READ?
   :READ?;:READ?
   ```

   The following command strings are valid:

   ```
   :SOUR:VOLT 4;*OPC?
   :SENS:NPLC 1.0;:SENS:CURR:RANG MIN
   :SENS:CURR:RANG? MAX
   :READ?
   ```

2. When a query is sent, either the data must be read back or a Device Clear (DCL) or Interface Clear (IFC) must be performed to reset the query.
3. When sending a command or query, do not attempt to read data from the power supply until the terminator has been sent (usually Line Feed with EOI). Otherwise, a DCL or IFC must be sent to reset the input parser.
4. When receiving data, all data, up to and including the terminator (LF with EOI), must be accepted. Otherwise, a DCL or IFC must be sent to reset the output task.
5. Empty command strings (terminator only) should not be sent.

Using SCPI-based programs

In general, an existing SCPI-based program will run properly and faster in the 488.1 protocol as long as it meets the previous guidelines and limitations.

Bus hold-off

*OPC, *OPC?, and *WAI are still functional but are not needed for the 488.1 protocol. When sending commands, the GPIB is automatically held off when it detects a terminator. The hold-off is released when all the commands have finished executing, or if there is some parser or command error.

Trigger-on-talk

Trigger-on-talk functionality has been added for the 488.1 protocol. If a query has not been received by the instrument, the power supply will automatically assume a read query command has been sent when it is addressed to talk. This technique increases GPIB speed by decreasing the transmission and parser times for the command. If the Models 2306 or 2306-PJ, then trigger on talk applies to the active channel (DISP:CHAN?). If active channel is channel 1, then it assumes a READ1?, else if channel 2 is active, then READ2?.

Message available

The MAV (message available) bit in the Serial Poll byte will be set when the query is finished being processed, not when there is data available in the output buffer (as with the SCPI protocol). For the 488.1 protocol, output data will not be formatted until the first request for data is received. This delay may cause unexpected timeouts when using SRQ on MAV for queries that take a long time to execute.

General operation notes

- The remote blinking R on the front panel still operates since it is critical to fundamental GPIB operation.

- If the unit is in REMote, the GTL command may not put the power supply into the local mode. Only the front panel LOCAL key is guaranteed to operate, if not in local lockout (LLO). GTL will still disable LLO.

- IEEE-488 bus commands and features (GET, IFC, SDC, DCL, LLO, Serial Poll, and SRQ) are still fully supported.

- Multiple TALKs on the same query are supported as in the SCPI protocol. This feature is useful when reading back long ASCII strings.

Trigger on talk both channels

> *NOTE:*   *This command applies only to Models 2306 and 2306-PJ.*

Trigger on talk will return a reading for the active channel (DISPlay:CHANnel?) unless you have enabled (ON) the setting for Trig on talk to return two readings—one from each channel comma delimited (for example: ch1 reading, ch2 reading). This command maps trigger on talk to BOTHREAD? when enabled.

To enable the two readings trig on talk and have it apply to both channels (READ1? for channel 1, READ 2? for channel 2), send:

```
SYSTem:TRIGger:TALK:BOTH ON
```

To disable the two readings trig on talk, send:

```
SYSTem:TRIGger:TALK:BOTH OFF
```

Bus commands

Table 1 contains the new bus commands.

Table 1
New bus commands (Firmware B08 and later)

Commands	Description	Default

:SYSTem
  :TRIGger
    :TALK
      :BOTH \<b\>
	Path to System commands.
	    Path to trigger commands.
	      Path to talk commands.
	      Set \<b\> to 1 (or ON) to enable 2 reading trig on talk. 0 (or OFF) disable 2 reading trig on talk, but reads the active channel:
	      `CH1: READ1?`
	      `CH2: READ2?`
		OFF

Command notes

SYSTem:TRIGger:TALK:BOTH \<b\>

This command can be sent in 488.1 or SCPI protocol. However, the setting only affects 488.1 protocol functionality and not used in SCPI protocol. On power up, this mode is set to disabled (OFF). This setting is not saved in user setups and is not affected by recalling a user setup or sending a *RST command. If enabled (ON), the trigger on talk maps to a BOTHREAD?. If disabled (OFF), then trigger on talk maps to a READ1? if channel 1 is active channel, or a read2? if channel 2 is active channel.

After enabling this command and doing a trigger on talk to get the two readings, the active channel (DISP:CHAN?) will be Channel 2. Therefore, when the command is disabled the active channel is 2.

Trigger Continuous Mode

While in continuous trigger mode, as soon as a reading is triggered and calculated, the next reading is triggered. On the first reading, the A/D is configured for the desired measurement. While in this mode, a special task is running to acquire the readings. Therefore, do not send any commands to the supply that changes how it is configured. Instead disable the mode, make the changes, and then enable the mode again. While in the mode, it is okay to send query commands.

Bus commands

Table 2 contains the new bus commands.

Table 2
New bus commands (Firmware B08 and later)

Commands	Description	Default

SYSTem
  TRIGger
    CONTinuous \<b\>
	Path to System commands.
	    Path to trigger commands.
	      Set \<b\> to 1 (or ON) to enable trigger continuous mode which automatically turns display OFF. 0 (or OFF) disables mode and automatically turns display back ON.
		OFF

Command notes

SYSTem:TRIGger:CONTinuous <b> Applies to active channel

Trigger Continuous Mode was designed for use in conjunction with disabling the system MEP mode (SYST:MEP:STAT 0). When Trigger Continuous Mode is enabled, the continuous trigger does not cycle background readings, process commands that affect the measurement configuration such as output state, function or integration time, etc., or service the other channel (if the instrument has two channels).

On power up, this mode is set to disabled (OFF). This setting is not saved in user setups. While this mode is enabled, do not recall a user setup or send an *RST command.

Using Trigger Continuous Mode

Trigger Continuous Mode provides a faster reading rate. The fastest reading rate is achieved by enabling this mode along with disabling MEP mode (SYST:MEP:STAT 0). Also, the format for readings can affect speed. Selecting SREal format will provide a faster reading rate than when in ASCII mode. Enabling trigger continuous mode turns display OFF while disabling it turns it back ON.

MEP mode disabled and trigger continuous mode enabled

When system MEP mode is disabled and trigger continuous mode is enabled, talking the instrument returns triggered readings. The query READ? does not have to be sent before talking the instrument for a reading. When using this configuration (MEP mode disabled and trigger continuous mode enabled), the instrument is continuously taking triggered readings. When the power supply is talked without being asked for data, a recently triggered reading is returned.

Changing instrument configuration

To change instrument configuration, disable trigger continuous mode first. Do not change configuration while trigger continuous mode is enabled. After sending the commands to make the desired changes, enable the trigger continuous mode and resume taking fast readings by just talking the instrument.

Programming sequence example

NOTE   *The following example assumes SYST:MEP:STAT is OFF.*

Command	Description
`*RST`	// Set the power supply to default reset conditions
`FORM SRE`	// Select SREal format for readings
Send commands here to configure the instrument for the desired measurements.	
`SYST:TRIG:CONT 1`	// Enable Continuous Trigger Mode which turns display OFF.
`*OPC?`	// Query the power supply for when done processing the commands to configure the // instrument for desired measurements
Talk the power supply to get the ASCII one response back for *OPC?	
Talk the power supply for readings	
Keep talking the power supply for readings	
If after taking readings and desire to make a change in configuration then...	
`SYST:TRIG:CONT 0`	// Disable Continuous Trigger Mode before changing other settings.This turns // display ON.
Send commands here to make the desired system change.	
`SYST:TRIG:CONT 1`	// Enable Continuous Trigger Mode which turns display OFF.
`*OPC?`	// Query the power supply for when done processing the commands to configure // the instrument for desired measurements
Talk the power supply to get the ASCII one response back for *OPC?	
Resume talking and taking power supply readings in continuos trigger mode.	

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 Models 2306 and 2306-PJ. Table 3 contains descriptions of the added commands.

> *NOTE:*   *No short form exists for any of the following commands.*

Table 3
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 Models 2306 and 2306-PJ, but do not work with the Models 2302 or 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/2303-PJ starting with firmware verion 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 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.