RC-50 Loop Station

Tempos and Tempo Sync

RC50WS06

About the RC-50 Workshop Series

The BOSS RC-50 Loop Station sets a new standard for performance loopers. With 49 minutes of mono recording time (or 24 minutes in stereo), onboard storage for up to 297 phrases, and massive realtime control, the RC-50 is a powerful performance tool. While looping is its primary function, it can be used in many other ways: as a sampler, a backing track player, a practice aid, and more.

Each RC-50 Workshop booklet focuses on a specific topic to help you get the most out of your RC-50 and to spark some ideas for its creative use. RC-50 Workshop booklets are intended as companions to the *RC-50 Owner's Manual*.

About This Booklet

The RC-50's tempo functions—patch and phrase tempos, and Tempo Sync—are essential tools for keeping your phrases and the guide playing at the right speed. In this booklet, we'll take a look at them in detail and offer tips for using them effectively.

Background Information

Tempos and Tempo Sync provides information beneficial for all RC-50 users, from beginner to advanced. However, it assumes that you're familiar with the RC-50's two Play modes—Single and Multi—and that you know how to do basic phrase recording and playback. For information on these functions, see the *RC-50 Owner's Manual* and the RC-50 Workshop booklets *Using Single Mode* and *Using Multi Mode*.

This booklet occasionally mentions the guide and Loop Quantize, two RC-50 features that utilize its various tempo functions. To learn more about these features, see the RC-50 Workshop booklet *The Guide and Loop Quantize* and Chapter 3 in the *RC-50 Owner's Manual*.

Understanding the Symbols in This Booklet

Throughout this booklet, you'll come across information that deserves special attention—that's the reason it's labeled with one of the following symbols.

A note is something that adds information about the topic at hand.

A tip offers suggestions for using the feature being discussed.

Warnings contain important information that can help you avoid possible damage to your equipment, your data, or yourself.

Hot Links

Each Workshop booklet is meant to be read in order from beginning to end. However, if we mention an upcoming section—and you see this arrow—you can click the arrow to jump there immediately.

Terminology

- On the RC-50, a "phrase" is a container for audio data.
- An RC-50 patch contains three phrases, and each can loop indefinitely or be triggered sampler-style using the "One Shot" function.
- When a phrase is empty, capturing audio into it is called "recording."
- While recording a phrase, pressing the REC/PLAY/OVERDUB pedal stops recording and starts the phrase playing back from the beginning. This action determines the phrase's length, and we call it "closing the phrase." Alternately, a phrase can be closed by pressing the STOP pedal during phrase recording.
- When a phrase already contains audio and you wish to layer more—or replace some—you "overdub" audio into the phrase.

Overview of Tempo Functions in the RC-50

With three phrases per patch, a built-in rhythm guide, and MIDI clock functionality, the RC-50 has a lot of things to keep in sync. To achieve this, it relies on various tempo settings—a master tempo for each patch, and separate tempos for each phrase.

In case you're wondering, you don't *have* to keep all phrases in sync if you don't want to—this will become apparent as you read this booklet.

The RC-50 uses tempos for four primary functions:

- To determine the playback speed of the guide.
- To define the length of a phrase's measures.
- To determine the playback speed of phrases when they're synced to the patch tempo.
- To determine the measure length reference for Loop Quantize.

About Tempo Sync

Tempo Sync—one of the RC-50's most powerful features—allows you to synchronize a phrase's tempo to the patch tempo, or vise versa. Each phrase has its own Tempo Sync switch, so you can choose whether you want to use it or not.

We'll discuss Tempo Sync in more detail later; but first, let's take a look at patch and phrase tempos, including what they are and how they're created. Once you understand how tempos work on the RC-50, the practical use of Tempo Sync will make a lot more sense.
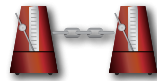
Patch Tempo

Each of the RC-50's 99 patches has its own patch tempo setting that provides a tempo reference for the following functions:

- *Guide speed*—The guide plays at the current patch tempo setting.
- *Tempo Sync*—When a phrase's Tempo Sync switch is on, the phrase plays at the patch tempo. (When Tempo Sync is off, the phrase ignores the patch tempo and plays at the tempo used when the phrase was recorded.)
- *Loop Quantize*—When Loop Quantize is on, newly-recorded phrases automatically conform to the patch tempo.
- *MIDI clock sync*—You can synchronize an external MIDI device to the RC-50, such as a drum machine, sequencer, an effects unit, or even another RC-50. In this setup, the external device follows the patch tempo.

Viewing the Current Patch Tempo

From the Play screen, press TAP TEMPO to view the current patch tempo setting.

The Play screen is the RC-50's "home" screen—it's the screen displayed after the RC-50 finishes its power-up sequence. You can always return to the Play screen from any other screen by pressing EXIT. To learn more, see the RC-50 Workshop booklet *Patches*.

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Patch:Tempo
          120.0
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The tempo is displayed as beats per minute, or "BPM."

The lights on the TAP TEMPO button and TEMPO pedal flash in different colors along with the patch tempo, with red indicating the first beat—or "downbeat"—of each measure, and green indicating all other beats.

Setting the Patch Tempo

The patch tempo can be set anywhere from 40 to 250 BPM using several different methods.

Setting the Patch Tempo Manually

Use this method to precisely set the patch tempo to a resolution as fine as one-tenth of a BPM.

1. From the Play screen, press TAP TEMPO.
2. Use the PARAMETER buttons to move the onscreen cursor under the desired digit.
3. Turn the PATCH/VALUE dial to the desired value.
4. When you're finished, press EXIT.

Tap Tempo

Another way you can set the patch tempo is by repeatedly pressing—or "tapping"—the TAP TEMPO button or TEMPO pedal. This allows you to easily set the tempo by tapping a beat with your finger or foot. The patch tempo is determined by the interval between the taps.

Tap the TAP TEMPO button...   ...or the TEMPO pedal.

The RC-50's TEMPO pedal—and the UNDO pedal as well—can be reassigned to control alternate patch functions (see Pages 70-71 in the *RC-50 Owner's Manual*). If the TEMPO pedal has been reassigned, it can't be used to set the tempo.

During Phrase Recording

Under certain conditions, the recording of a particular phrase will determine the patch tempo.

Setting the Patch Tempo with Tempo Sync

Tempo Sync will automatically set the patch tempo after phrase recording when these conditions are met:

In Single mode—

- The guide is off.
- The desired phrase's Tempo Sync switch is on.

In Multi mode—

- The guide is on.
- The desired phrase's Tempo Sync switch is on.
- All other phrases are stopped.

Immediately after recording, the patch tempo is set to match the newly recorded phrase's tempo.

The RC-50 calculates a phrase's tempo automatically based on a few variables. We'll cover this in the "Phrase Tempo" section coming up.

Though it may not be apparent at the moment, using Tempo Sync to define the patch tempo is a very powerful feature, especially when using Multi mode. We'll discuss this more in the "Tempo Sync Tips" section later in the booklet.

Setting the Patch Tempo with Loop Sync

Multi mode's Loop Sync feature provides an easy way to keep phrases in sync with each other. When it's on, the longest phrase in the patch determines the loop playback length for all the patch's phrases.

If you're using Loop Sync to create a multi-phrase loop performance and you start with three empty phrases, the first phrase you record will determine the loop playback length. If the guide is off, the recording of this first phrase also sets the patch tempo.

> To learn more about Loop Sync, see the RC-50 Workshop booklet *The Guide and Loop Quantize* and Chapter 5 in the *RC-50 Owner's Manual*.

External Sync

When the RC-50 is set to receive a MIDI clock signal at its MIDI IN jack, the patch tempo follows the incoming MIDI clock tempo. This allows you to synchronize the RC-50's phrases and guide to an external MIDI device.

> For more on external MIDI sync settings, see Chapter 8 in the *RC-50 Owner's Manual*.

Phrase Tempo (Original Tempo)

Each RC-50 phrase has its own unique tempo setting that's calculated automatically immediately after recording. Since this tempo calculation happens when the phrase is originally recorded, it's called the "original tempo."

When using Tempo Sync, the RC-50 uses the phrases' original tempos as timing references for synchronizing them to the patch tempo.

> When you're not using the RC-50's Tempo Sync function, you really don't need to be concerned with the phrases' original tempos. They only come into play when using Tempo Sync.

How the Original Tempo is Calculated

The RC-50 calculates a newly recorded phrase's original tempo based upon its length and the current time signature setting. Depending on the conditions during phrase recording, the calculation matches the current patch tempo or is an on-the-fly computation by the RC-50.

- *If Loop Quantize is on during phrase recording*—the phrase's original tempo is set to match the current patch tempo.
- *If Loop Quantize is off during phrase recording*—the RC-50 calculates the original tempo based on the phrase's length.

> Loop Quantize is on when its front panel indicator is lit.

Accurate Phrase Tempos when Loop Quantize is Off

Loop Quantize is always active when recording phrases in reference to another timing source, be it the guide, another phrase whose Tempo Sync is on, or when the RC-50 is synced to an external MIDI device such as a drum machine. In these instances, Loop Quantize does all the work matching newly recorded phrases to the patch tempo.

However, when Loop Quantize is off, you're on your own. Here are a few tips to help the RC-50 calculate the original tempo accurately.

- Set the desired time signature before phrase recording.

> The patch's time signature is among the RC-50's guide parameters. Guide settings are discussed in the RC-50 Workshop booklet *The Guide and Loop Quantize*, and in Chapter 3 of the *RC-50 Owner's Manual*.

- Tap your foot in time before recording, and press REC/PLAY/OVERDUB with one of your taps to begin recording.
- Play with a steady tempo during phrase recording.
- Close the phrase exactly on the downbeat of a measure.

- Don't record phrases with mixed time signatures (for example, two measures of 4/4 and one measure of 3/4). The RC-50 can't calculate an accurate original tempo for a phrase with mixed time signatures.

This doesn't mean you *can't* record phrases with mixed time signatures—it only means that you may have trouble using Tempo Sync with them.

Viewing/Editing a Phrase's Original Tempo

To view and/or edit a phrase's original tempo:

1   Press the PHRASE EDIT button for the desired phrase.

2   Use the PARAMETER buttons to display the selected phrase's Original Tempo screen.

3   If you wish to edit the original tempo, use the PARAMETER buttons to move the onscreen cursor under the desired digit, and then turn the PATCH/VALUE dial to change its value.

In this example we've selected Phrase 1's original tempo.

You can also tap the TAP TEMPO button to set the original tempo while you're on this screen.

4   To view another phrase's original tempo, press its PHRASE EDIT button. To edit this phrase's original tempo, use the procedure described in Step 3.

5   Press EXIT when you're done.

When to Edit the Original Tempo

When you've recorded a phrase in the RC-50, it's usually best to leave its automatically calculated original tempo value alone. Changing it may cause the phrase to play at an unpredictable speed when Tempo Sync is switched on.

Changing the original tempo value doesn't have any effect on a phrase's playback if its Tempo Sync switch is off.

That said, here are a few instances where you might want to change the original tempo after the fact:

- *The automatic calculation isn't accurate*—When recording with the guide off, you might occasionally find that the original tempo is not an accurate representation of the actual tempo of the phrase.
- *You want to turn on the phrase's Tempo Sync switch, but not have its original playback speed changed*—If you set the phrase's original tempo to the same value as the patch tempo, its playback speed will be unchanged even if Tempo Sync is on.
- *Importing audio into the RC-50's phrases via USB*—When you import a WAV audio file from your computer into a phrase, there's no way for the RC-50 to know what the WAV file's tempo is. If you want to use Tempo Sync with the imported audio, you'll need to manually set the phrase's original tempo after the import. (We'll show you how to determine a phrase's tempo next.)

To learn about importing WAV audio files via USB, see Chapter 9 in the *RC-50 Owner's Manual*.

If you do decide to change a phrase's original tempo, make a note of the automatically calculated setting so you can return to it later if you wish.
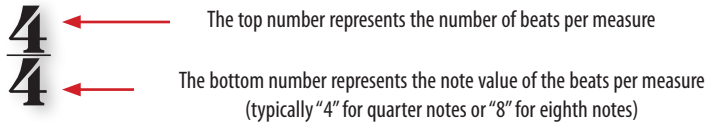
Manually Calculating a Phrase's Tempo

Here's how to figure out an audio file's tempo on your own, such as when you're working with a WAV file imported via USB.

96 BPM

96.00

First, you'll need to know a few things about the audio file:

- *Its total length*—in seconds.
- *The time signature*—of the musical content it contains. The time signature defines how many beats are in each measure, and the note value of those beats.

$\frac{4}{4}$

The top number represents the number of beats per measure

The bottom number represents the note value of the beats per measure (typically "4" for quarter notes or "8" for eighth notes)

- *The number of measures*—in the musical content, determined by the total number of beats.

With this information in hand, dig out your calculator and use the following formula to determine the file's tempo in BPM:

Beats per measure (time signature top number)	÷
Note value (time signature bottom number)	x
4	x
Number of measures	x
60	÷
Length (in seconds)	=
Phrase tempo BPM	

As an example, say you've imported a two-measure WAV file with a 4/4 time signature, and its total length is five seconds. Using the formula above, calculate its tempo:

4 (Beats per measure)	÷
4 (Note value)	x
4	x
2 (Number of measures)	x
60	÷
5 (Length in seconds)	=
96 BPM	

Based on the calculation, the WAV file's tempo is 96 BPM. So, just set the original tempo of the RC-50 phrase containing the imported audio to 96 BPM, and you're good to go.

A patch's time signature can't be changed if any of its phrases contain audio. Therefore, before importing an audio file into a phrase, set the patch's time signature first. Make sure you set it to match the time signature of the audio file's musical content!

Some computer audio software applications have functions to determine the tempo of a particular audio file. If you have audio software on your computer, check its documentation to see if it has this ability—it can be a real time-saver!

If you've purchased a commercial CD or CD-ROM containing drum loops or other audio phrases, their tempos are usually provided in accompanying documentation.

If you're importing audio phrases from the *Sound Library for RC-50 CD* (one of the accessories that ships with the RC-50), you'll find their tempos on Page 103 in the *RC-50 Owner's Manual*.
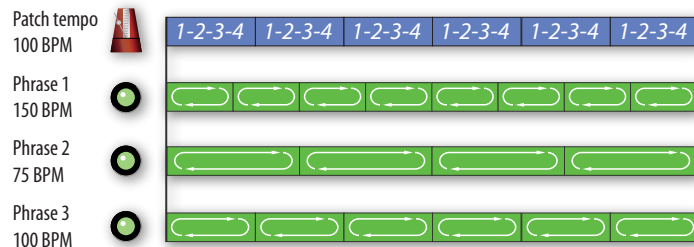
Using Tempo Sync

The RC-50's Tempo Sync feature allows you to synchronize a phrase's tempo to the patch tempo. This is accomplished in realtime using a digital time-shifting algorithm that changes the phrase's speed—and therefore its measure length—without changing its pitch.

When a phrase's Tempo Sync switch is on, it plays at the patch tempo. When it's off, the phrase plays at its original tempo. The RC-50 bases the Tempo Sync calculation on the mathematical relationship between the patch tempo and the phrase's original tempo.

> To get an accurate playback tempo with Tempo Sync, it's important that a phrase's original tempo value be accurate.

The following illustrations show how Tempo Sync works. In both, the patch tempo is set to 100 BPM, and all three phrases contain one measure of audio. However, their original tempos are different from each other. The first illustration shows the phrases' playback lengths with their Tempo Sync switches off, and the second shows them with their Tempo Sync switches on.

Here, all phrases' Tempo Sync switches are off. Each phrase loops at its own original tempo, ignoring the patch tempo.
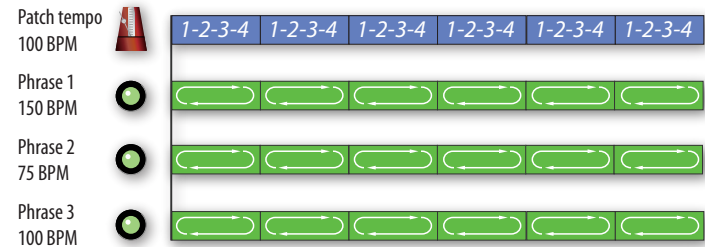
Here, all phrases' Tempo Sync switches are on, which aligns their lengths to the patch tempo.

With Tempo Sync on, the phrases' lengths are adjusted to match the patch tempo. The exception here is Phrase 3—its original tempo is 100 BPM, the same as the patch tempo. Even though its Tempo Sync switch is on, the RC-50 doesn't need to change Phrase 3's length to match the patch tempo because it already does.

Enabling Tempo Sync

Each phrase has its own Tempo Sync switch. Use the following procedure to enable or disable Tempo Sync for each phrase.

> All phrases must be stopped before the current Tempo Sync settings can be changed.

1 Press the PHRASE EDIT button for the desired phrase.

2 Use the PARAMETER buttons to display the selected phrase's Tempo Sync screen.

3 Turn the PATCH/VALUE dial to choose the desired setting: ON or OFF.

In this example we've selected Phrase 3's Tempo Sync screen.

4 To adjust another phrase's Tempo Sync setting, press its PHRASE EDIT button, and then use the procedure described in Step 3.

5 Press EXIT when you're done.

Tempo Sync Tips

Time-Shifting and Audio Quality

Time-shifting requires very intensive realtime calculations, and the RC-50's brain has to crunch thousands of numbers per second on-the-fly when Tempo Sync is active. Depending on the complexity of a phrase's audio, the sound quality of the time-shifted result will vary, with the best results being achieved with less complex material. The recording mode also has an effect, as stereo audio is twice as difficult to time-shift than mono audio. Another factor is how far the audio is time-shifted from its original tempo, with better quality the less it's shifted. Keep these considerations in mind to achieve the best results when time-shifting with Tempo Sync.

Tempo Sync and Drum Loops

The RC-50's time-shifting algorithm works extremely well with percussive material, making drum and percussion loops some of the most practical candidates for Tempo Sync. You can record drum loops directly into a phrase, or import them into phrases via USB. Then, with Tempo Sync, you can freely adjust the playback tempo of the loop for further recording and overdubs of more complex audio material.

In this way, you can use pre-loaded drum or percussion loops—or your own percussive phrases—as rhythmic alternatives to the RC-50's built-in guide.

Using Tempo Sync to Set the Patch Tempo

As discussed earlier in "Setting the Patch Tempo," Tempo Sync can be used to set the patch tempo under certain conditions. Here's an example of how this can be handy.

Multi Mode: ON, Guide: OFF, Loop Sync: OFF

Phrase Number	Tempo Sync Switch	Phrase Content	One Shot Mode
1	On	Empty	LOOP
2	Off	Empty	LOOP
3	On	Drum Loop	LOOP

In this example patch, the RC-50's in Multi mode, the guide and Loop Sync are off, and all phrases are set for looped playback. Phrases 1 and 2 are empty, but we've got a 4/4 drum loop imported into Phrase 3. Though we want to use the drum loop as a rhythmic backing, we don't want it to start playing right away; we'd like to record an audio loop (a chord progression, for example) into Phrase 1 first, and then start Phrase 3 playing a little later. Of course, when Phrase 3's drum loop starts, we want it to play in time with our looping Phrase 1.

The key to making this happen is by using Tempo Sync. In our example patch, we've turned on the Tempo Sync switches for Phrases 1 and 3. This allows the recording of Phrase 1 to *set* the patch tempo, and also makes Phrase 3 play *at* the patch tempo. Follow along as we walk through how this works:

1 With the RC-50 stopped, select Phrase 1 for recording by pressing its PHRASE SELECT pedal.
2 Tap your foot in a steady rhythm at the desired tempo.
3 When you're ready to start recording, press the REC/PLAY/OVERDUB pedal once, in time with your foot taps. Phrase 1 begins recording.
4 During recording, play with a steady 4/4 rhythm. This will ensure an accurate original tempo calculation.
5 When you wish to close Phrase 1, press REC/PLAY/OVERDUB. The phrase starts looping, and the patch tempo is set to match this newly recorded phrase's original tempo.

To get an accurate original tempo, make sure you close the phrase exactly at the beginning of a measure.

7 With Phrase 1 looping, select Phrase 3 by pressing its PHRASE SELECT pedal. At the desired beat (the beginning of a measure would be best), press REC/PLAY/OVERDUB to start Phrase 3 playing. With Tempo Sync on, Phrase 3's drum loop starts playing at the patch tempo, in time with Phrase 1. Pretty cool, huh?

> When starting a new phrase playing while another is currently playing— as in our example—it helps to tap your foot in time and start playback with one of your taps.

One final note: In our example patch, we've turned Phrase 2's Tempo Sync switch off. This means that its original tempo won't be influenced by the patch tempo, or vice versa. As such, it's best to record audio into Phrase 2 while Phrase 1 and/or Phrase 3 are playing. In addition to providing a timing reference, this will enable Loop Quantize during recording, as discussed next.

Tempo Sync and Loop Quantize
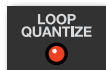
When the RC-50's in Multi mode—and when the guide and Loop Sync are off—playing a phrase with its Tempo Sync switch on will enable Loop Quantize during the recording of other phrases. This allows the RC-50 to automatically adjust a newly recorded phrase's measure length to match that of a previously recorded phrase, which keeps the phrases in sync with each other.

For example, this is especially useful when you're using one phrase for a short rhythmic backing and the other two phases for longer musical material such as chord progressions. When you turn on Tempo Sync for the rhythmic phrase and start it playing, it becomes the Loop Quantize reference for the recording of the other two phrases—when those phrases are closed, Loop Quantize automatically aligns their endings to match the measure length of the Tempo Sync'd phrase.

> See the RC-50 Workshop booklet *The Guide and Loop Quantize* for a detailed explanation of this functionality.

If You Don't Need it, Turn it Off

As we've seen, Tempo Sync's ability to automatically set the patch tempo can be very useful. However, there are a few playing scenarios where this may be undesirable. In these cases, it would be best to turn all phrases' Tempo Sync switches off to avoid any time-shifted "surprises" when switching between phrases.

One of these scenarios is when you're using Multi mode—with the guide and Loop Sync off—to create the atmospheric textures popular in ambient looping styles. This often involves recording and playing free-form loops with no time reference to each other.

Another situation is when you're using Single mode phrases to create separate song sections one after the other with the guide off. If Tempo Sync is on for all phrases, the patch tempo—and the previously recorded phrase's playback tempo—will change after each new phrase recording. To preserve the phrases' original playback tempos, turn their Tempo Sync switches off.

Save Different Setups in Patches

Since phrases' Tempo Sync settings can be stored in patches, try saving your favorite combinations in your own custom blank patches—with no audio yet recorded in their phrases—to use in different playing situations.

For example, if you like to work a lot without Tempo Sync, create a patch that has all its Tempo Sync switches off. Or, if you like to use Multi mode as described in "Tempo Sync and Loop Quantize," create a patch that has Tempo Sync on for your Loop Quantize reference phrase (or phrases) and off for the others.

Of course, many other settings can be saved in patches as well. By customizing different patches for different playing situations, you can have a number of blank slates at the ready to use as starting points for your looping adventures.

> To learn how to save patches, see the RC-50 Workshop booklet *Patches* and Page 54 in the *RC-50 Owner's Manual*.

An RC-50 patch that's in an initialized state—that is, a blank patch set to factory default settings—has the Tempo Sync switches on for all of its phrases. To learn how to initialize a patch, see the RC-50 Workshop booklet *Patches*.

For the latest RC-50 updates and support tools, visit the BOSS U.S. Web site at *www.BOSSUS.com*. If you need personal assistance, call our amazing Product Support team at 323-890-3743.

Using Tempo Sync for Phrase Training

Since Tempo Sync changes a phrase's speed without changing its pitch, it's ideal for learning fast musical phrases—such as guitar solos—that are difficult to learn at their normal speed.

To get the desired audio into an RC-50 phrase, simply record it from a CD or MP3 player, or import it from a computer via USB. Then, turn on the phrase's Tempo Sync switch, start playback, and slow the patch tempo to the desired speed.

Depending on the source audio, the sound quality might be adversely affected when the phrase is slowed down considerably (we discussed the reasons for this earlier in "Time-Shifting and Audio Quality"). However, it'll usually be clear enough to achieve the desired goal, which is to slow it down enough so you can learn the desired musical content.

Experimenting with the phrase's original tempo setting can sometimes affect the quality of its Tempo Sync'd audio. Normally, you wouldn't want to randomly mess with the original tempo. But since you're learning musical phrases in this application, you don't need to be concerned with getting an accurate playback tempo—you just want the audio to sound as clear as possible when it's slowed down.

The End

We hope you've found this workshop helpful. Keep an eye out for other RC-50 Workshop booklets, available for downloading at *www.BOSSUS.com* and *www.RolandUS.com*.