

Direct In-Bound Fax Routing Utilizing DTMF Tones With TR Series Loop-Start Cards

This document is intended to highlight some system characteristics that are necessary in order to implement a direct inbound fax routing solution using DTMF tones generated by telecommunications equipment, a TR series loop-start card, and a suitable LAN Fax application. A general outline will be followed by technical detail of certain key features and characteristics for each element of the system. This document is intended for use by VARs and system integrators, however it may be of use to developers unfamiliar with this method of routing. This implementation often uses features of a PABX and application software that were not intended for this purpose, and the installation can require a degree of improvisation. Where possible inbound routing using a Brooktrout basic rate ISDN card is advised for faster, more reliable service.

Operation

1. The sending fax machine dials the number for the TR114.
2. PABX rings the TR114, and plays ringing tone to the sending fax machine.
3. TR114 answers the call (goes off-hook).
4. PABX senses this, and sends down the last few digits of the dialed number as DTMF tones.
5. Application software collects these digits and looks up in a table, to determine who or where to route the incoming fax.
6. PABX connects the sending fax machine to the TR114.
7. The fax is then received and routed to the correct location.

System Requirements

The PABX should:

- Provide a standard loop-start line for the TR114.
- Be capable of assigning a sub-group of numbers to a single port. When any number within the subgroup is dialed, the call is automatically routed to the same port.
- Be able to send down the dialed number, or part of the dialed number to the port as DTMF digits after the call has been answered. This is commonly called **after-dialing**, and is a feature provided for the PABX to communicate with other peripherals, such as voice mail.
- Send the first DTMF digit *no earlier* than 200ms after the call has been answered by the TR114. Ideally this parameter would be programmable, or significantly longer than the 200ms required by the TR114 to allow for delays within the application.

Many systems are capable of sending down a pre-defined number of digits, and stripping off any leading digits. For example, a typical system can be programmed to send down the last 4 digits.

Network FAX application

The application must support inbound routing by DTMF tones. This feature is often provided so that a user may route a fax to a particular fax mailbox (network user) using the following method:

1. Dialing the main fax number.
2. Waiting for the call to be answered.
3. Entering a DTMF code on the fax machine keypad for the fax mailbox (network user).
4. Sending the fax.

Developer Note: The application should enable tone detection quickly (ideally immediately after answering the call). For example, the Brooktrout API sequence would be:

```
BfvLineAnswer  
BfvToneDetectEnable
```

TR114

We recommend using TR114 Firmware V17b and above, as some previous versions may have DTMF detection problems.

The latest firmware is available from Brooktrout's FTP site (<ftp.brooktrout.com>) and BBS (781-449-9279).

For advice on recognizing the version of firmware you have, contact **Brooktrout Technical Support**.

Ascom Fax Router

The Ascom Fax Router is often used in cases where a PABX is incapable of providing after-dialed digits, or where a PABX is unavailable.

If you are using an Ascom Fax Router to perform inbound routing from an ISDN line, the advice regarding TR114 firmware is still valid.

The critical delay between detecting that the call has been answered and sending down the first digit can be programmed within the Ascom to be up to 25 seconds. In the Ascom this is referred to as **Rdelay** (its default value is four seconds). This should enable the Ascom to be compatible with the timing of any network fax application while performing DTMF inbound routing. If the application enables tone detection immediately after answering the call, the TR114 is capable of operating with Rdelay set at its minimum value of 700ms.

Ascom firmware version 260396R0 should be avoided. This version can cause calls to not be completed, and the line to become disconnected almost immediately. The Ascom firmware version can be identified by pressing the Service button and scrolling down to view the software revision. The firmware can be updated remotely (contact Ascom technical support for details).

Testing

PABX Call Grouping and After-dialing, Initial Test

This test is a very simple test to show that DTMF digits are being sent by the PABX.

1. Connect an analog phone to the PABX extension that the TR114 is to be connected.
2. Dial a number within the selected range from a different line.
3. Pick up the telephone and listen for the DTMF tones.

DTMF tone capture with TR114

This test will confirm that the TR114 is capable of capturing the DTMF tones, and will display the tones on the screen.

1. Obtain the test program **faxdtmf** from the Brooktrout FTP site or BBS.
2. Install and run the program following the supplied documentation.
This utility will display the tones captured by the TR114 from the PABX; it will then go into fax receive.
3. Pay particular attention to non-numeric and additional digits.

Test the application for DTMF routing

This test will ensure that the application is correctly configured to route faxes using DTMF tones. The tones will be generated manually, by pressing a keypad, rather than automatically by the PABX.

1. Connect the TR114 to a standard loop-start line or extension, without any after-dialed DTMF digits.
2. Enable logging in the application to such a level that will detail the DTMF digits that the application captures and identifies.
3. Dial the TR114.
4. Wait for the call to be answered.
5. Note if a tone or message is played.
6. Enter a DTMF code on the fax machine keypad for the fax mailbox (network user).
7. Send the fax.
8. Review the log.

Problems

In the event of any problems, follow all test procedures described above.

Q: *My application works fine when I test it manually (test 3), and I can hear tones from the PABX (test 1) but when I connect the two together, my application doesn't recognize any DTMF digits. When I run the faxdtmf test program (test 2), I can see that the PABX sends down the DTMF digit "A" before the routing digits.*

A: Some PABXs may send some of the extended range of DTMF digits available, any of A, B, C or D. In this particular case the PABX is sending "A" so that a voice mail system knows to "answer." Some applications terminate the DTMF capture when any digit other than a number is identified.

The PABX may be able to be programmed to not send the digit down or to change it for a numeric digit, and the routing table configured accordingly for this extra "dummy" digit.

Developer Note:

Another possible solution, one that many applications employ, is for the application to enable tone detection using the following Brooktrout API command:

```
BfvToneDetectEnable(1p,DTMF_12TONE)
```

rather than

```
BfvToneDetectEnable(1p,DTMF_16TONE)
```

With tone detection enabled using **BfvToneDetectEnable(1p,DTMF 12TONE)**, the

TR114 will only recognize 0-9*# and will not pass the digits A-D to the application.

- Q: *I have a similar problem to this, but this PABX sends down the DTMF digit "*" prior to the routing digits, and the application terminates.*
- A: The PABX may be able to be programmed to not send the digit down or to change it for a numeric digit, and the routing table configured accordingly for this extra 'dummy' digit. It may also be possible to change it to A,B,C or D if the TR114 is configured to ignore these digits.
It may be possible to configure the application program to not terminate on any specific digit, or to terminate on a different digit to the one used by the PABX.
- Q: *I always miss the first DTMF digit when using the faxdtmf test program (test 2).*
- A: If the PABX is definitely sending down the digit, confirmed by other test equipment, then the delay between detecting that the call has been answered and sending down the first digit appears to be less than the 200ms required.
Ideally this delay could be increased within the PABX.
One alternative that has been used (although not recommended), is to send a dummy digit or additional routing digit. Clearly, this should only be considered when the number of digits missed is reliably constant, and all other avenues have been exhausted.
- Q: *I capture all the digits when using the **faxdtmf** test program (test 2). They are all numbers, but miss the first one or two when I use my application.*
- A: This might be caused by the application delaying the enabling of tone detection after answering the call. This may be to play a tone or message, in order to indicate to a user manually entering digits when they can start entering the digits. This feature would be identified during test 3, and can sometimes be disabled.
This may also be caused by the application using a firmware version prior to V17b.
- Q: *I capture a large string of digits when using the faxdtmf test program (test 2), they are all numbers and the routing digits are in the middle, but my application only captures the last seven.*
- A: Some PABXs place the routing information at the front or in the middle of a string of digits that may be up to forty digits long. Application programs rarely provide facilities for processing such strings, and typically the user is limited to specifying how many of the trailing digits to capture.
The PABX may be able to be programmed to not send the additional non-routing digits down. If this characteristic of PABX cannot be altered, then the application program must be altered to be able to filter and process such digit strings.
- Q: *I have a TR112, will this work in the same manner as a TR114?*
- A: All of the advice given in the document is equally valid when using a TR112. The only exception is the firmware versions, since the TR112 does not have downloadable firmware.