



Configuring Digital Tenors for ISDN/PRI Use

December 2004

Tenor, Tenor Carrier MultiPath Switch (CMS), PacketSaver, Quintum, Quintum Technologies, Inc., VoIP Made Easy, TASQ, SelectNet, and SelectNet Technology are trademarks of Quintum Technologies, Inc. Other trademarks appearing in this document are the property of their respective owners.

© **Copyright 2004** Quintum Technologies, Inc. All Rights Reserved.



Introduction	3
Required Information.....	3
Configuring 1G Tenors for ISDN	4
Trunk Group Settings	4
Signaling Group Settings.....	5
1G Command Quick List	9
Trunk Group Commands.....	9
Signaling Group Commands	10
Configuring 2G Tenors for ISDN	14
Trunk Group Settings	14
Signaling Group Settings.....	14
Channel Group Settings	18
2G Command Quick List	20
Signaling Group.....	20
Channel Group Commands.....	30
Common Alarms	33
Associated Event Log Modules	34
TON/NPI Brief Explanation.....	37
NPI (Numbering Plan ID).....	37
TON (Type of Number).....	37
Tenor Number Parsing	38



Introduction

This document provides customers the necessary information and examples to configure their Quintum Digital Tenor to connect to an ISDN PRI line provided by either a PBX, PSTN provider, or other switch.

This document shows and discusses the necessary parameters required to configure the Digital Tenor to support ISDN. It does not show dial plan or routing information.

This document also does not provide engineers any in-depth knowledge of ISDN itself. Engineers are encouraged to refer to the many books available on ISDN, as this will provide a more detailed knowledge of the technology.

Required Information

Before connecting an ISDN line to the Digital Tenor, we advise that the engineer gather the information below. This will ensure a smoother installation with fewer problems.

- Type of line (T1 or E1). This will be important to know before you can get the ISDN portion up and running.
- Physical configuration of lines (Framing, line coding, CRC setting).
- The Tenor interface to use (PBX, PSTN, or both). This may depend on your application.
- ISDN Switch protocol (connecting to or emulating)
- ISDN Orientation (Master/Network or Slave/User)



Configuring 1G Tenors for ISDN

When you are finished making changes, do not forget to submit the configuration. Also, after you submit the changes to switch to ISDN, we recommend that you reset the Tenor.

Trunk Group Settings

When you have collected all of the information discussed under *Required Information*, you are ready to configure the Tenor for ISDN. The Tenor comes defaulted for CAS (Channel Associated Signaling) for both the PBX and the PSTN trunk groups. You will need to change this for the trunk group you are going to use for this application.

- If you are going to use only the PSTN interface, then you only need to configure the PSTN trunk group.
- If you are going to use the PBX interface, then you configure just the PBX trunk group.
- If you are going to use both, then you must configure both trunk groups.

To access a trunk group from the Quintum prompt, type the following:

```
Quintum> config pbx 1 <enter>
```

This will bring you to the first PBX trunk group.

OR

```
Quintum> config pstn 1 <enter>
```

This will bring you to the first PSTN trunk group.

If a trunk group is currently set to CAS, you first must change the signaling type from CAS to CCS¹ (Common Channel Signaling), which is ISDN. To change this to CCS, type this command:

```
config pstn 1> ccsorcas 0
```

This trunk group is now set up for CCS/ISDN. All of the information pertaining to CAS is now hidden. You will need to create signaling groups.

NOTE:

Once you configure a trunk group for CCS, you cannot split that trunk group up. Each interface will only support 1 trunk group for ISDN.

¹ Many times in telecommunications, you will see ISDN and CCS used interchangeably. They mean exactly the same thing.

overlapdial

Overlap dialing needs to be set according to the type of dialing scheme that is supported by this ISDN connection.

- When set to No (0), the Tenor expects to see the dialed number presented en-bloc, or all together in the Calling Party ID element of the Setup message. The Tenor then sends the digits all together to the PSTN as well.
- When overlap is set to Yes (1), then the Tenor does not get all of the digits in the setup message. It may receive some in the setup message, and then get a separate message for each digit dialed thereafter. If the call is to go to the PSTN, then the Tenor also sends the digits as overlap.

If this parameter is not set correctly, calls may fail. Additionally, the Tenor can only receive overlap digits from the PBX interface. The Tenor cannot receive overlap from the PSTN because a real PSTN provider would not send overlap digits to the Tenor. They always send en-bloc. To set this parameter, type the command followed by either 0 (no) or 1 (yes), as follows:

```
config pbxtg 1# overlap 1 <enter>
```

Signaling Group Settings

Once you have configured the appropriate trunk group for ISDN (CCS), all you have done is set up the trunk group to use ISDN. Now you must create and configure the ISDN group, and then assign the signaling group to the appropriate trunk group. The maximum number of signaling groups that you create should not exceed 2 (one for each trunk group PBX/PSTN).

When you create signaling groups, it is recommended that you create signaling group 1 for the PBX trunk group/interface and signaling group 2 for the PSTN trunk group/interface. It is not necessary to do it in this way, but it will make it easier later on to troubleshoot and correlate the configuration.

To create a signaling group from the Quintum prompt, type the following:

```
Quintum> config signal 1
```

OR

```
Quintum> config signal 2
```

There are several parameters to configure, described below:

name

Once at the signaling group prompt, you must configure a name to enable a group. The name can be any mixture of numbers and characters. For example, you can type:

```
config signaling 1# name PBX-ISDNGroup
```

This will assign the name pbx-isdngroup to this signaling group, which is now available for you to configure.

If no name is assigned, then the signaling group is disabled or deleted. You must enter a name to activate this signaling group so that you can see the parameters and configure it.

isdnprottype

This stands for ISDN Protocol Type. This is the switch type that you will be connecting to. The Tenor supports 5ESS, 4ESS, DMS (Nortel), NI2, INSNET 1500, ETSI, QSIG and DASS 2. You will need to find out from your PSTN provider, switch vendor or PBX vendor what switch type they are using or emulating. Typically, 4ESS, 5ESS, DMS and NI2 are used in the U.S. ETSI is prevalent in Europe. QSIG is also used in Europe and South America. This does not limit the use of these switch types, just provides some guidelines. DMS has been used in other countries besides the U.S.

Once you know the switch type, you simply enter the command and the number corresponding to the switch type. For example, to use ETSI, you would type:

```
config signaling 1# isdn 5
```

This sets the ISDN protocol to ETSI.

orientation

Orientation has to do with the timing of the message flow, or who sends what when. There are 2 types of orientation; User/Slave and Network/Master. When dealing with orientation, you must think, “opposites attract.” This means that this signaling group’s orientation must be the opposite of the orientation of the line it is connecting to. If you are connecting to the PSTN, then the PSTN will always be Network/Master and you would set the Tenor to be User/Slave for this signaling group. Typically, a PBX will be User/Slave, so you would configure the Tenor to be Network/Master for the signaling group. If you were going to have both a connection to a PBX and to a PSTN (installing the Tenor on an existing ISDN line), then you would configure signaling group 1 (for the PBX) as Network/Master and signaling group 2 (for the PSTN) as User/Slave.

If you are connecting to a switch, such as an Excel or Dialogic board, you will have to check with the switch vendor/configuration to see how it is configured. Don’t forget, “opposites attract.”

To set the orientation, simply type in the command and then either 0 for user/slave or 1 for network/master:

```
config signaling 1# orient 1
```

Sets the orientation to Network/Master.

ignoretonnpi

When this is set to Yes (default value), then any call that comes in on the interface assigned to this signaling group, the TON (Type of Number) and NPI (Numbering Plan ID) sent in the Q931 Setup Message in the Calling Party ID element will be ignored and the Tenor will set it to unknown/unknown. This means that when we receive a call, and this parameter is set to Yes, we will say that the call is public and we will look to use our standard routing and normalization method to build the number to E.164 format (country code + city/area code + local number).

If this is set to No, then the call is presented to the Tenor in terms of the TON and NPI. The Tenor will handle it and forward it on with the same parameters. In most cases, leaving this parameter set to Yes will be fine.



For more information on TON/NPI, please see [TON/NPI Brief Explanation](#) at the end of this document, or refer to a Q.931 reference guide.

To change this parameter, simply type the command and either 0 for no or 1 for yes:

```
config signaling 1# ignore 0
```

Sets this to No.

dchnum

This stands for the D-Channel Number. ISDN PRI lines use 1 of the channels on the T1 or E1 for call control. This is called the D-Channel. On T1, it is always on channel 24. On E1, it is always on channel 16. Set this based on the type of line you are using.

NOTE

While it is possible to set this to any channel, Quintum has not tested having the D-channel on any other channels except 24 for T1 and 16 for E1.

To set this or change it, simply type the command and the channel number:

```
config signaling 1# dch 16
```

Sets the D channel to channel 16.

fasunit

This refers to the unit number where this signaling group will be assigned. This was put in for future use, but has no significance at present time. It must always be set to 1 (default).

fasline

This refers to the interface (PBX or PSTN) where you want to assign this signaling group. 1 refers to the PBX interface, and 2 refers to the PSTN interface. The default is always set to 1. To change this, simply type the command and then either 1 (for PBX) or 2 (for PSTN):

```
config signaling 2# fasline 2
```

Assigns this signaling group to the PSTN interface.

linkestablishment

This command tells the Tenor what to do when the D-channel goes out of service for some reason. In its default mode of always (option 1), if the D-channel goes down, the Tenor will always try to start the D-channel back up. This is a normal course of action. However, for certain test facilities, this may not be desirable. You can choose the “on demand” setting (option 1). When set this way, if the D-channel goes down, the Tenor will only try to start it when a call is attempted. The call will fail because the D-channel is down, but the next time the call is attempted, the D-channel should be active. For most applications, the default value will work fine. To change this, type the command followed by either 1 (Always) or 2 (On Demand);

```
config signaling 1# linkest 2
```

Sets this to on demand.

relayprog

This command is used to decide whether to send a Q.931 progress message to the device connected to this signaling group/interface. There are some switches that when they are sent the progress message, will fail even though this message is standard for ISDN and Q.931. The default is set to Yes (1) so the Tenor will send progress messages through when necessary. To change this issue the command followed by either 0 for No or 1 for Yes;

```
config signaling 1# relayprog 0
```

Sets this to No so that a progress message is not sent.

delsiggrp

This is used to delete this signaling group. When you type this, it will automatically delete the signaling group.

1G Command Quick List

This section provides a quick list of the commands described in the preceding section.

Trunk Group Commands

ccsorcas

Description	Used to configure the signaling type for this trunk group. Can change between CAS (Channel Associated Signaling) or CCS (Common Channel Signaling) which is also ISDN.
Prompt Level	config pstntg 1# or config pbxtg 1#
Syntax	ccsorcas or ccs {0 1}
Arguments	0 CCS/ISDN. Sets the signaling for this trunk group to CCS/ISDN. 1 CAS. Sets the signaling for this trunk group to CAS.
Settings	None
Default	1 (CAS)
Availability	All Digital Tenor Releases
Example	config pstntg 1# ccsorcas 1 Sets the pstn trunk group to CAS signaling. config pbxtg 1# ccs 0 Sets the pbx trunk group to CCS signaling.

overlap

Description	Used to enable or disable overlap dialing for ISDN.
Prompt Level	config pstntg 1# or config pbxtg 1#
Syntax	overlap or over {0 1}
Arguments	0 No. Overlap dialing is disabled. 1 Yes. Overlap dialing is enabled.
Settings	None
Default	0 (No)
Availability	All Digital Tenor Releases
Example	config pstntg 1# over 1 Enabled overlap dialing.

Signaling Group Commands

name

Description	Used to configure a name for this signaling group. You must have a name configured to enable this group.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	name [<i>name</i>]
Arguments	name Required. Alpha-numeric string that is entered to be the name of this group. No spaces are allowed.
Settings	None
Default	Null
Availability	All Digital Tenor Releases
Example	config signaling 1# name pbx_isdn-01

isdnproctype

Description	Used to select the ISDN protocol type or switch type for ISDN signaling.																
Prompt Level	config signaling x# (x represents either 1 or 2)																
Syntax	isdnproctype or isdn {0 1 2 3 4 5 6 7}																
Arguments	<table><tr><td>0</td><td>5ESS</td></tr><tr><td>1</td><td>4ESS</td></tr><tr><td>2</td><td>DMS</td></tr><tr><td>3</td><td>NI2</td></tr><tr><td>4</td><td>INSNET 1500</td></tr><tr><td>5</td><td>ETSI</td></tr><tr><td>6</td><td>QSIG</td></tr><tr><td>7</td><td>DASS 2</td></tr></table>	0	5ESS	1	4ESS	2	DMS	3	NI2	4	INSNET 1500	5	ETSI	6	QSIG	7	DASS 2
0	5ESS																
1	4ESS																
2	DMS																
3	NI2																
4	INSNET 1500																
5	ETSI																
6	QSIG																
7	DASS 2																
Settings	None																
Default	0 (5ESS)																
Availability	All Digital Tenor Releases																
Example	config signaling 1# isdn 2 Sets the protocol type to DMS.																

orientation

Description	Used to set the signaling orientation for ISDN. It is important to set this correctly. The Tenor should always be set to the opposite of the connection. If the Tenor is connecting to the PSTN, then this should be set to User/Slave as the PSTN will always be Network/Master. If you are connecting to a PBX, then typically, the Tenor will be setup as Network/Master (to look like the PSTN) and the PBX will be User/Slave. If you are connecting to a switch, verify this setting with your switch vendor.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	orientation or orie {0 1}
Arguments	0 User/Slave 1 Network/Master
Settings	None
Default	0 (User/Slave)
Availability	All Digital Tenor Releases
Example	config signaling 1# orie 1 Sets the Orientation to Network/Master.

dchnum

Description	Used to select what channel will be used for the D channel. At present time, the Tenor has only been tested and will only support a D channel on channel 24 for T1 and channel 16 for E1.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	dchnum or dch {16 24}
Arguments	16 Sets the D-channel to channel 16 (for E1). 24 Sets the D-channel to channel 24 (for T1).
Settings	None
Default	24
Availability	All Digital Tenor Releases
Example	config signaling 1# dch 16 Sets the D-channel to channel 16.

fasunit

Description	Used to select the unit number where this group will be assigned. This is a feature for Multi-Unit Operation that is not supported at this time. Should be set to 1.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	fasunit or fasun {n}
Arguments	n The number of the unit that will be assigned. Should always be 1.
Settings	None
Default	1
Availability	All Digital Tenor Releases
Guidelines	Do not change this number.
Example	config signaling 1# fasunit 1

fasline

Description	Used to select which line this signaling group will be assigned to. You can select either the PBX or the PSTN interface.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	fasline or fasl {1 2}
Arguments	1 PBX Interface 2 PSTN Interface
Settings	None
Default	1 (PBX)
Availability	All Digital Tenor Releases
Example	config signaling 1# fasline 2 Sets the line to the PSTN interface.

linkeestablishment

Description	Used to set how the Tenor establishes the D-channel if it should go out of service.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	linkeestablishment or link {1 2}
Arguments	1 Always. Tenor always tries to start the D-channel. 2 On Demand. Tenor only tries to restart D-channel when a call is made.
Settings	None
Default	1 (Always)
Availability	All Digital Tenor Releases
Example	config signaling 1# link 2 Sets the link establishment to on demand.

relayprog

Description	Used to set whether the Tenor should send a progress message (when necessary) out of this interface/group.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	relayprog or relay {0 1}
Arguments	0 No. Tenor will not send a progress message out. 1 Yes. Tenor will send a progress message (when necessary).
Settings	None.
Default	1 (Yes)
Availability	All Digital Tenor Releases
Example	config signaling 1# relay 0 Tenor will not send progress message out.

ignoretonnpi

Description	Used to set whether the Tenor should ignore the incoming TON and NPI (thereby setting them to unknown/unknown) or not ignore them.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	ignoretonnpi or ign {0 1}
Arguments	0 No. Tenor will not ignore the TON and NPI. 1 Yes. Tenor will ignore the TON and NPI.
Settings	None
Default	1 (Yes)
Availability	All Digital Tenor Releases
Example	config signaling 1# ign 0 Tenor will not ignore the TON and NPI.

delsiggrp

Description	Used to delete this signaling group.
Prompt Level	config signaling x# (x represents either 1 or 2)
Syntax	delsiggrp or delsig
Arguments	None
Settings	None
Default	None
Availability	All Digital Tenor Releases
Example	config signaling 1# delsig Deletes this signaling group.

Configuring 2G Tenors for ISDN

When you are finished making changes, do not forget to submit the configuration. Also, after you submit the changes to switch to ISDN, we recommend that you reset the Tenor.

Trunk Group Settings

When you have collected all of the information discussed under *Required Information*, you are ready to configure the Tenor.

- If you are going to use only the PSTN interface, then you only need to configure the Trunk Circuit Routing Group (TCRG).
- If you are going to use only the PBX interface, then you configure just the Line Circuit Routing Group (LCRG).
- If you are going to use both, then you must configure both groups.

TCRG is usually the best Routing Group type to use in typical 2G Tenor applications, even if the channels are connected to a PBX. Line Circuit Routing Groups (LCRG) are usually only for enterprise applications where pass-through functionality is desired. In almost all cases, TCRGs provide more robust routing capabilities.

To access a trunk group from the Quintum prompt, type the following:

```
Quintum> lcrng 1 <enter>
```

This will bring you to the first LCRG trunk group.

OR

```
Quintum> tcrng 1 <enter>
```

This will bring you to the first TCRG group.

You will need to associate the Trunk Group with a Channel Group that is also associated with an ISDN Signaling Group. See *In Configuration Manager*, navigate to:

```
Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN  
Signaling Group-n > General tab > D Channel
```

This feature is enabled by default. Click the checkbox to disable the feature.

Channel Group Settings for more details.

overlapdial

This feature only applies to CAS (non-ISDN) configured lines. With 2G Tenors, Overlap dialing is always supported on CCS (ISDN) lines, so this feature has no effect.

You will need to create and configure an ISDN signaling group, and then associate it to a Channel Group.

Signaling Group Settings

Once you have configured the appropriate trunk group for ISDN (CCS), you must create and configure the ISDN signaling group. Then you must assign the signaling group to the appropriate trunk group. The maximum number of signaling groups that you create should



not exceed 4 for the Tenor AX/AS/BX/DX, and 8 for the Tenor CMS. By default, there is an ISDN signaling group-1 in place.

To create a signaling group (named “T1 4ESS”) from the Quintum prompt, type the following:

```
config# new isdnsg "T1 4ESS"
```

In *Configuration Manager*, navigate to:

Circuit Configuration > Signaling Configuration > ISDN Signaling Groups

Right-click on ISDN Signaling Groups, and select New. Enter the name of the group.

To delete a signaling group from the CLI prompt:

```
config-ISDN signaling group-1# delete isdnsg "T1 4ESS"
```

To delete a signaling group from Configuration Manager, navigate to:

Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n

Right-click on ISDN Signaling Group-n and select Delete.

name

Once at the signaling group prompt, you must configure a name to enable a group. The name can be any mixture of numbers and characters. For example, you can type:

```
config-ISDN signaling group-1# name PBX-ISDNGroup
```

This will assign the name pbx-isdngroup to the signaling group ISDN SG-1, which is now available for you to configure.

In *Configuration Manager*, navigate to:

Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > Right-click and select New > Specify a Unique Name dialog > ISDN Signaling Group

Enter a unique name.

protocol

This is the ISDN Protocol Type, which specifies the switch type that you will be connecting to. The Tenor supports 5ESS, 4ESS, DMS (Nortel), NI2, INSNET 1500, ETSI, QSIG and DASS 2. For BRI, the Tenor also supports NET3, CCITT QSIG, S031, 1TR6, NTT, and VNX.

You will need to find out from your PSTN provider, switch vendor, or PBX vendor what switch type they are using or emulating.

Typically, 4ESS, 5ESS, DMS and NI2 are used in the U.S. ETSI is prevalent in Europe. QSIG is also used in Europe and South America. This does not limit the use of these switch types, just provides some guidelines. DMS has been used in other countries besides the U.S.

Once you know the switch type, you simply enter the command and the number corresponding to the switch type. For example, to use ETSI, you would type:

```
config-ISDN signaling group-PBX-ISDNGroup# set prot 5
```

Sets the Protocol to PRI_ETSI for this signaling group.



To change this parameter, simply type the command and either 0 for no or 1 for yes:

```
config-ISDN signalingGroup-PBX-ISDNGroup# ignore 0
```

Sets this to No.

In *Configuration Manager*, navigate to:

Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > Ignore TON NPI

Select a setting from the drop-down box.

dch

This stands for the D-Channel Number. ISDN PRI lines use 1 of the channels on the T1 or E1 for call control. This is called the D-Channel. On T1, it is always on channel 24. On E1, it is always on channel 16. Set this based on the type of line you are using.

This setting is not available for BRI.

To set this or change it, simply type the command and the channel number:

```
config-ISDN signalingGroup-PBX-ISDNGroup# dch 16
```

Sets the D channel to channel 16.

In *Configuration Manager*, navigate to:

Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > D Channel

Select a channel number from the drop-down box

l2estab

This command tells the Tenor what to do when the D-channel goes out of service for some reason. In its default mode of always (option 1), if the D-channel goes down, the Tenor will always try to start the D-channel back up. This is a normal course of action. However, for certain test facilities, where this may not be desirable, you can choose the “on demand” setting (option 0). When set this way, if the D-channel goes down, the Tenor will only try to start it when a call is attempted. The call will fail because the D-channel is down, but the next time the call is attempted, the D-channel should be active. For most applications, the default value will work fine. To change this setting, type the command followed by either 0 (On Demand) or 1 (Always).

```
config-ISDN signalingGroup-PBX-ISDNGroup# l2estab 0
```

Sets this group to on demand.

In *Configuration Manager*, navigate to:

Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > Layer2 Link Establishment

Select Always or On Demand from the drop-down box

relayprogress

This command is used to decide whether to send a Q.931 progress message to the device connected to this signaling group/interface. There are some switches that when they are sent the progress message, will fail even though this message is standard for ISDN and Q.931. The default is set to Yes (1) so the Tenor will send progress messages through when necessary. To change this, issue the command followed by 0 for No.

```
config-ISDN signalingGroup-PBX-ISDNGroup# relayprog 0
```

Sets this to No so that a progress message is not sent.

In *Configuration Manager*, navigate to:

Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > D Channel

This feature is enabled by default. Click the checkbox to disable the feature.

Channel Group Settings

For an **ISDN signalingGroup** to be “in effect,” you must associate it with a Channel Group.

A Channel Group consists of one or more channels from a line device. All channels are associated with a particular Signaling Group for setting up a call or a service, and a Routing Group (either Line Side or Trunk Side).

When a T1/E1 Line Interface Card is installed, one Channel Group is automatically configured for each interface. It is assigned a name that represents its physical location; for instance, if an 8-port card is installed in Slot 11, the Channel Groups would be named SL11DV1DI1, SL11DV1DI2, SL11DV1DI3 through SL11DV1DI8. All available channels (24 for T1, 30 for E1) are pre-assigned to these Channel Groups.

Signaling Group Attached

In the CLI, go to the prompt for the Channel group, specifying the Digital Interface. You will issue a command that associates a specific ISDN Signaling Group with that Channel Group.

```
config-ChannelGroup-SL11DV1DI1-# set sga[1] isdnsg-1
```

Associates Signaling Group ISDNsg-1 with Channel Group SL11DV1DI1.

In *Configuration Manager*, navigate to the Digital Interface window. This is located in a slightly different location in the software, depending on your device.

Tenor DX: *DSI Configuration > Digital Interface-n*

Tenor BX: *BRI Configuration > Digital Interface-n*

Tenor CMS: *Chassis Configuration > Slot-n > DSI > Digital Interface-n*

On the Channels tab, click **Add** or **Edit** to manage the ISDN Signaling Group association.

Routing Group Attached

In the CLI, go to the prompt for the Channel group, specifying the Digital Interface. You will issue a command that associates a specific Routing Group with that Channel Group.

```
config-ChannelGroup-SL11DV1DI4# set rga tcrq-1
```

Provides the connecting point between Channel Group SL11DV1DI4 and Routing Group TCRG-1.

In *Configuration Manager*, navigate to the Digital Interface window. This is located in a slightly different location in the software, depending on your device.

Tenor DX: *DSI Configuration > Digital Interface-n*

Tenor BX: *BRI Configuration > Digital Interface-n*

Tenor CMS: *Chassis Configuration > Slot-n > DSI > Digital Interface-n*

On the Channels tab, click **Add** or **Edit** to manage the Routing Group association.

2G Command Quick List

Signaling Group Commands

Name

Description Names the ISDN Signaling Group. Used strictly as an identification label.

Configuration Manager

Location *Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > Description*

Options Enter a descriptive name.

Command Line

Cmd Type Command

Prompt Level config- ISDN Signaling Group -1#

Syntax **set name** {name}

Guidelines You may use spaces, but if you do, the name must be enclosed with "quotation marks." Maximum of 31 characters.

Examples config- ISDN Signaling Group -1# **set name "T1 PRI"**
Sets the Group's name to T1 PRI.

PROToCol

- Description** The **PROToCol** command sets the ISDN protocol/switch type to be used. Depending on the device, PRI and BRI protocols are supported.
- Guidelines** It is important to find out the exact configuration of the lines beforehand. The following protocols are supported.
- **PRI 5ESS** - 5ESS is the class 5 ISDN central office circuit switching system developed by AT&T.
 - **PRI 4ESS** - 4ESS is the class 4 US AT&T proprietary version of ISDN.
 - **PRI DMS** - DMS is a digital circuit-switching standard developed by Nortel Networks.
 - **PRI NI2** - This is the CCITT National ISDN 2 PRI standard.
 - **PRI INSNET 1500** - This is the standard digital switching developed by NTT in Japan.
 - **PRI ETSI** - This is the standard developed by the European Telecommunications Standards Institute.
 - **PRI QSIG** - The QSIG protocol provides signaling for Private Integrated services Network Exchange (PINX) devices. It is based on the ISDN Q.931 standard.
 - **BRI NET3** - This supports NET3 (TBR3) ISDN, and covers Euro-ISDN, and is ETSI-compliant.
 - **BRI CCITT QSIG** - This supports switches with QSIG signaling per the Q.931/Q.921 ISDN spec.
 - **BRI S031** - This supports Australian S031 ISDN switches.
 - **BRI 1TR6** - This supports German 1TR6 ISDN switches.
 - **BRI NTT** - This supports Japanese NTT ISDN switches.
 - **BRI VNX** - This supports French VNX ISDN switches.

Configuration Manager

Location *Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > Protocol*

Options Select from the drop-down box. Options are as follows:

- PRI 5ESS
- PRI 4ESS
- PRI DMS
- PRI NI2
- PRI INSNET 1500
- PRI ETSI
- PRI QSIG
- BRI NET3
- BRI CCITT QSIG
- BRI S031
- BRI 1TR6
- BRI NTT
- BRI VNX

Command Line

Cmd Type	Command
Prompt Level	config- ISDN signalingGroup -1#
Syntax	set protocol or prot {0 1 2 3 4 5 6 17 18 19 20 21 22}
Arguments	0 PRI 5ESS 1 PRI 4ESS 2 PRI DMS 3 PRI NI2 4 PRI INSNET1500 5 PRI ETSI 6 PRI QSIG 17 BRI NET3 18 BRI CCITT QSIG 19 BRI S031 20 BRI 1TR6 21 BRI NTT 22 BRI VNX
Default	0 PRI_5ESS
Examples	config- ISDN signalingGroup -1# set prot 5 Sets the Protocol to PRI_ETSI for this signaling group.

ORIENTATION

- Description** The **ORIENTATION** command is used to set the ISDN signaling orientation.
- Guidelines** There are two orientations: User and Network.
- When this signaling group is connected to a PSTN/Trunk-Side Connection (the PSTN would be the network), then the **ORIENTATION** would be set to User.
 - If this signaling group is connected to a PBX/Line-Side Connection, (which is typically User) then the **ORIENTATION** would be Network.
 - If you are connecting to other types of devices (IVRs, Switches, etc.), you should check the setting of those devices and set this command to the opposite setting to maintain symmetry.

Note

When connected to a Tenor BX, the options for this command are displayed as follows:

- TE (same as User/Slave)
- NT (same as Network/Master)

When ISDN SG Orientation is changed from TE to NT, the primary and secondary clock sources will be affected. If the clock source is set to Digital Line and the clock line ID is affected by the orientation change, then the clock source will be automatically set to internal.

Configuration Manager

- Location** *Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > Orientation*
- Options** Select from the drop-down box:
- User/Slave
 - Network/Master

Command Line

Cmd Type	Command
Prompt Level	config- ISDN signalingGroup -1#
Syntax	set orientation or or {0 1}
Arguments	0 User/Slave 1 Network/Master
Default	0 User/Slave
Examples	config- ISDN signalingGroup -1# set or 1 Sets the orientation to Network for this Signaling group.

DCH

Description	D Channel Number. Used to set the channel that will be used as the D-Channel for ISDN signaling. When left set to 0 (default), the 2G Tenor automatically sets the D-Channel to 16 (when associated with E1) or 24 (when associated with T1).
Guidelines	T1 ISDN lines use channel 24 for the D-channel while E1 ISDN lines use channel 16. When you switch from T1 to E1, this parameter may not update automatically.
	Note This command does not apply to BRI devices (Tenor BX).

Configuration Manager

Location	<i>Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > D Channel</i>
Options	Select from the drop-down box. Options are as follows: <ul style="list-style-type: none"> Automated Channel 1-31 (select a value in this range, inclusive)

Command Line

Cmd Type	Command
Prompt Level	config- ISDN Signaling Group -1#
Syntax	dchnum or dch {n}
Arguments	n Required. Numeric value that is the channel number to be used as the D-Channel.
Default	0 Automatically sets to 16 (for E1) or 24 (for T1)
Examples	config- ISDN Signaling Group -1# set dch 16 Sets the D-channel to channel 16.

L2Estab

Description	<p>The L2Estab (Layer 2 Link Establishment) command is used to set how the Tenor reacts to a D-Channel failure.</p> <p>Typically, when a D-channel goes down, the Tenor does not allow any calls to attempt to go out of the line with the failure, and constantly tries to restart the D-channel. This is called Always.</p> <p>However, in some situations where the D-channel has been idle for a certain period of time, the trunk-side will "turn off" the D-channel. You may not always want to try to bring up the D-channel or not allow calls to go out this line. In this case, when the D-channel goes down, the Tenor reports the alarm, but does not attempt to restore the D-channel. When a call is made that needs to go out of this interface, the Tenor then attempts to bring the D-channel up. The call attempt will fail, but by the time the user re-dials, the D-channel should be up and ready to go. This is called On Demand.</p>
Guidelines	Typically, you would leave this set to Always.

Configuration Manager

Location	<i>Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > Layer2 Link Establishment</i>
Options	Select from the drop-down box. Options are as follows: <ul style="list-style-type: none"> • On Demand • Always

Command Line

Cmd Type	Command
Prompt Level	config- ISDNSignalingGroup -1#
Syntax	set l2estab {0 1}
Arguments	0 On Demand 1 Always
Default	1 Always
Examples	config- ISDNSignalingGroup -1# set l2estab 0 Sets this parameter to On Demand, as described above.

RelayProgress

Description	Selects whether or not to send Progress Messages on an ISDN interface.
Guidelines	In most instances, you will not need to change this setting.

Configuration Manager

Location	<i>Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > Relay Progress</i>
Options	This feature is enabled by default. Click the checkbox to disable the feature.

Command Line

Cmd Type	Command
Prompt Level	config- ISDNSignalingGroup -1#
Syntax	set relayprog or rp {0 1}
Arguments	0 Off 1 On
Default	1 On
Examples	config- ISDNSignalingGroup -1# set rp 0 Sets this parameter to "off," as described above.

IgnoreTonNPI

Description **IgnoreTonNPI** lets you configure the system to ignore the Type Of Number (TON) and Numbering Plan Index (NPI) and set them to unknown internally.

A setting of "128" indicates that the type of number and numbering plan will be ignored and internally set to unknown.

A setting of "0" tells the system to observe the TON and NPI and treat the call accordingly. This function is primarily used to override incorrect values being sent over a trunk, which is unfortunately somewhat common.

For example, if calls are arriving on this routing group with a TON of 1 (International), but the actual DNIS is prefixed with an 011 (or 00, etc.), the system will not delete the 011 and will incorrectly attempt to route with the 011 as part of the E.164 number. Setting IgnoreTonNPI to 128 will allow the system to properly remove the 011 and route the call correctly.

The reverse also occasionally occurs in the field. A call is presented in E.164 format, but coded with a TON of "unknown." You can use this command to force it to be treated as an International/ISDN call by setting this value to 145.

Guidelines Typically, you would set this to properly observe the TON and NPI. Set to 0 (default). The next most common value is 128, to ignore the inbound TON and NPI and treat all calls as unknown/unknown.

This parameter may make more sense if it were called "ForceTonNPI" as that is what it is really doing, it is far more powerful than a simple boolean "ignore/observe." For advanced usage (very uncommon) it should be noted this is a "bit-mapped" parameter, which explains the strange settings available. For 99% of situations, you do not need this.

On the other hand, it is quite powerful, and the bits are interpreted as follows:

128	64	32	16	8	4	2	1
force	TON	TON	TON	NPI	NPI	NPI	NPI

You "set" the bits in binary as noted above to "force" the TON and NPI as you require, adding up the decimal values above the bits. The first bit is telling the system to observe the following bits, enabling this feature. The first bit must be set for the remaining bits to be observed. The TON and NPI values are binary representations of the TON and NPI values, refer to the TON and NPI descriptions in the HopOff number Directory section for the correct values.

IgnoreTonNPI of 128 is interpreted as follows:

128	64	32	16	8	4	2	1
force	TON	TON	TON	NPI	NPI	NPI	NPI

1	0	0	0	0	0	0	0

So, a setting of 128, which is 10000000 in binary, tells the system to force all calls to a TON and NPI of zero (unknown/unknown, respectively).

IgnoreTonNPI of 145 is interpreted as follows:

128	64	32	16	8	4	2	1
force	TON	TON	TON	NPI	NPI	NPI	NPI
1	0	0	1	0	0	0	1

This forces the inbound call to be treated as TON of 1, NPI of 1, regardless of the value presented over the trunk.

If you require this override functionality, and do not understand the use of bit-mapped parameters, please contact the Quintum Technical Assistance Center for guidance.

Configuration Manager

Location	<i>Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n > General tab > Ignore TON NPI</i>
Options	Select from the drop-down box. Options are as follows: <ul style="list-style-type: none"> • No, Observe both TON & NPI • Yes, Ignore both TON & NPI • Treat International TON, ISDN NPI

Command Line

Cmd Type	Command
Prompt Level	config- ISDNISignalingGroup -1#
Syntax	set ignoretonnpi or itnpi {number}
Arguments	0 Observe TON and NPI. 1 or 128 Ignore TON and NPI, force to be treated as "unknown/unknown." 145 Force inbound call treatment of TON of International, NPI of ISDN.
Default	0 Observe TON and NPI as delivered over the trunk.
Examples	config- ISDNISignalingGroup -1# set itnpi 1 Sets this Signaling Group to Ignore TON/NPI information.

To delete an existing ISDN Signaling Group

- Description** This deletes an existing ISDN Signaling Group.
- Guidelines** Keep in mind that there is a limit on how many ISDN Signaling Groups may be created:
- CMS - 8
 - Tenor AS/AX/DX - 4

Configuration Manager

- Location** *Circuit Configuration > Signaling Configuration > ISDN Signaling Groups > ISDN Signaling Group-n*
- Options** Right-click on ISDN Signaling Group-n and select Delete.

Command Line

- Cmd Type** Command
- Prompt Level** config #
- Syntax** **delete isdnsg** {name}
- Arguments** **name** Alphanumeric string that provides a label to identify this Directory.
- Examples** `config-# delete isdnsg "T1 4ESS"`
Deletes the ISDN Signaling Group named T1 4ESS.

Channel Group Commands

To associate an ISDN Signaling Group with a Channel Group

- Description** This associates an ISDN Signaling Group with a Channel Group.
- Guidelines** Keep in mind that there is a limit on how many ISDN SGs may be created:
- CMS - 8
 - Tenor AS/AX/DX - 4

Configuration Manager

- Location** *DS1 Configuration > Digital Interface-n > Channels tab > Add/Edit Channel Group > Channel Group dialog > Associated Signaling Group*
- Options** Select the defined ISDN Signaling Group from the drop-down box.

Command Line

- Cmd Type** Command
- Prompt Level** config ChannelGroup-x#
- Syntax** **set sga[1] {name}**
- Arguments** **name** Alphanumeric string that provides a label to identify this Directory.
- Guidelines** You may use spaces, but if you do, the name must be enclosed with "quotation marks." Maximum of 31 characters.
- Examples** `config-ChannelGroup-SL11DV1DI1-# set sga[1] isdmsg-1`
Associates Signaling Group ISDMSG-1 with Channel Group SL11DV1DI1.
- Sample Display**
- ```
ChannelGroup- SL11DV1DI1 :
 SignalingGroupAttached : ISDN Signaling Group-1
 RoutingGroupAttached : TrunkCircuitRoutingGroup-1
```

## SignalingGroupAttached

**Description** **SignalingGroupAttached** is used to create an association between a Signaling Group and a Channel Group.

**Related Topics** [ISDN Signaling Group-1 \(isdnsig 1\) Prompt Commands](#)

### Configuration Manager

**Location** *DS1 Configuration > Digital Interface-n > Channels tab > Add/Edit Channel Group > Channel Group dialog > Associated Signaling Group*

**Options** Select the defined Signaling Group from the drop-down box.

### Command Line

**Cmd Type** Command

**Prompt Level** config-ChannelGroup-{cgroupname}#

**Syntax** **set sga** {sgname}

**Arguments** **sgname** Alphanumeric string that identifies a Signaling Group.

**Default** None

**Examples**

```
config- ChannelGroup-SL11DV1DI4# set sga isdnsig-1
```

Provides the connecting point between Channel Group SL11DV1DI4 and Signaling Group ISDNSG-1.

```
config- ChannelGroup-SL4DV1DI8# set sga cassg-1
```

Provides the connecting point between Channel Group SL4DV1DI8 and Signaling Group CASSG-1.

## RoutingGroupAttached

**Description** **RoutingGroupAttached** is used to create an association between a Routing Group and a Channel Group.

### Configuration Manager

**Location** *DS1 Configuration > Digital Interface-n > Channels tab > Add/Edit Channel Group > Channel Group dialog > Associated Routing Group*

**Options** Select the defined Routing Group from the drop-down box.

### Command Line

**Cmd Type** Command

**Prompt Level** config-ChannelGroup-{cgroupname}#

**Syntax** **set rga** {rgname}

**Arguments** **rgname** Alphanumeric string that provides a label to identify a Routing Group.

**Default** None

**Examples**

```
config- ChannelGroup-SL11DV1DI4# set rga tcrg-1
```

Provides the connecting point between Channel Group SL11DV1DI4 and Routing Group TCRG-1.

```
config- ChannelGroup-SL4DV1DI8# set rga lcrg-1
```

Provides the connecting point between Channel Group SL4DV1DI8 and Routing Group LCRG-1.

## Common Alarms

The following alarms may be observed in conjunction with ISDN.

### ***Loss of Framing (Red Alarm)***

This indicates that the Tenor does not detect any framing from the far end connection (PBX, PSTN or local switch). This is a layer 1 alarm meaning that layer 1 or the physical layer of the T1 or E1 is not active yet.

Common causes of this are no cable connection, broken or damaged cable, incorrect cable pin-out (T1 straight versus T1 cross-over), or incorrect configuration for the T1/E1 in terms of framing, line code, and/or CRC (all found in the line 1 x# prompt).

Verify that the alarm is present for the interface you are using by checking the line number. Line 1 is for PBX and line 2 is for PSTN. If you have this alarm for line 1 (PBX), but you are only using the PSTN interface (line 2), then this alarm can be ignored.

### ***Yellow Alarm***

Similar to the Red Alarm, this is a layer 1 or physical layer alarm. It indicates that the Tenor is receiving framing from the far end connection, but the far end connection is not receiving anything from the Tenor. Common causes of this alarm are broken or damage cable, incorrect cable pin-out, and incorrect configuration of the T1 or E1.

### ***Layer 2 Down***

This alarm indicates that the D-channel is not active on the line. You will see this alarm in conjunction with the above alarms, or by itself. If one of the previous alarms are also present for the same line (1 or 2), then you will need to address the other alarms first as the D-channel cannot be active if the T1/E1 itself is not active.

Common causes of this alarm are Loss of Framing (Red Alarm) or Yellow Alarm on the line indicating that the physical line is not active, incorrect configuration in terms of either the isdn protocol type/switch type or the orientation.

### ***Miscellaneous Information***

#### ***(PriManager: Signaling group for line x configured without the associated trunk group)***

This is a report and will only be shown in the alarm history (ala his). This alarm means that there is a signaling group created that is associated to line x (either 1 for PBX or 2 for PSTN), but the trunk group for that line is not configured for ISDN (ccsorcas = 0). Check your signaling groups and trunk group configuration for this mis-match.

### ***Major Software Error***

#### ***(PriTG: Trunk group line x is not associated with any signaling group)***

This is a report and will only be shown in the alarm history (ala his). This means that there is a trunk group created for line x (either 1 for PBX or 2 for PSTN), where the ccsorcas command is set for CCS (ISDN), but there is no signaling group associated to this trunk group. Go through your configuration and check your trunk groups and signaling groups.

## Associated Event Log Modules

Along with ch, q9xx and hdlc will provide you with ISDN logs of the calls. We suggest you start with just ch and q9xx as the hdlc is all in hex and our engineers use this for troubleshooting.

To start this log, type the following;

|                             |                                                                                                      |
|-----------------------------|------------------------------------------------------------------------------------------------------|
| Quintum> <b>ev 0</b>        | This will disable all modules previously set.                                                        |
| Quintum> <b>ev +ch q9xx</b> | This will enable both the ch and q9xx modules.                                                       |
| Quintum> <b>ev l3</b>       | This is the letter l and not the number 1. This will set the detail to level 3 for most information. |
| Quintum> <b>ev c</b>        | This will clear the event log buffer.                                                                |
| Quintum> <b>q</b>           | This will quit from command mode and start running the log.                                          |

An example of the log is shown below:

```

Q9XX :453617250:XMIT[1]
 SAPI: 0 TEI: 0 Frame: I
 C/R bit: SET(RSP) P/F bit: CLR N(R): 106 N(S): 6

 Q.931 Type: Setup
 CALL REFERENCE:
 Len = 2 Value = 16213 Flag = [0] (ORG)
 BEARER CAPABILITY IE:
 Coding Std: CCITT
 Info Xfer Capability: 3.1 kHz Audio
 Xfer Mode: Circuit Info Xfer Rate: 64 kbps
 User Layer 1 Protocol: G.711 Mu-law
 CHANNEL ID IE:
 Interface ID: Implicit Interface Type: PRI
 Pref/Excl: Pref D-ch Indicator: NOT D-ch
 Coding Std: CCITT Channel Map: Channel
 Chan/Map Units: B-chan
 Channel: 1
 CALLED PARTY # IE:
 Type of Number: Subscriber #
 Numbering Plan: ISDN (E.164/E.163)
 Called Party # Info ==>> 4609000

```

Tenor is transmitting a setup to line 1 (PBX) sending the digits 4609000.

```

Q9XX :453617257:RECV[1]
 SAPI: 0 TEI: 0 Frame: RR
 C/R bit: SET(CMD) P/F bit: CLR N(R): 7

```

Q9XX :453617281:RECV[1]  
SAPI: 0 TEI: 0 Frame: I  
C/R bit: CLR(RSP) P/F bit: CLR N(R): 7 N(S): 106

Q.931 Type: Call-Proceeding  
CALL REFERENCE:  
Len = 2 Value = 16213 Flag = [1] (DEST)  
CHANNEL ID IE:  
Interface ID: Implicit Interface Type: PRI  
Pref/Excl: Excl D-ch Indicator: NOT D-ch  
Coding Std: CCITT Channel Map: Channel  
Chan/Map Units: B-chan  
Channel: 1

Tenor receives from the PBX interface (1) a call proceeding.

Q9XX :453617281:XMIT[1]  
SAPI: 0 TEI: 0 Frame: RR  
C/R bit: CLR(CMD) P/F bit: CLR N(R): 107

Q9XX :453617332:RECV[1]  
SAPI: 0 TEI: 0 Frame: I  
C/R bit: CLR(RSP) P/F bit: CLR N(R): 7 N(S): 107

Q.931 Type: Alerting  
CALL REFERENCE:  
Len = 2 Value = 16213 Flag = [1] (DEST)

Tenor receives from the PBX interface (1) an alerting.

Q9XX :453617332:XMIT[1]  
SAPI: 0 TEI: 0 Frame: RR  
C/R bit: CLR(CMD) P/F bit: CLR N(R): 108

Q9XX :453617346:XMIT[2]  
SAPI: 0 TEI: 0 Frame: RR  
C/R bit: CLR(CMD) P/F bit: SET N(R): 93

Q9XX :453617346:RECV[2]  
SAPI: 0 TEI: 0 Frame: RR  
C/R bit: CLR(CMD) P/F bit: SET N(R): 123

Q9XX :453617355:RECV[1]  
SAPI: 0 TEI: 0 Frame: I  
C/R bit: CLR(RSP) P/F bit: CLR N(R): 7 N(S): 108

Q.931 Type: Connect  
CALL REFERENCE:  
Len = 2 Value = 16213 Flag = [1] (DEST)  
PROGRESS INDICATOR IE:  
Coding Standard: CCITT  
Location: User  
Progress Description: Destination address is non-ISDN

Tenor receives from the PBX interface (1) a connect.

Q9XX :453617355:XMIT[1]

SAPI: 0 TEI: 0 Frame: RR  
C/R bit: CLR(CMD) P/F bit: CLR N(R): 109

Q9XX :453617360:XMIT[1]  
SAPI: 0 TEI: 0 Frame: I  
C/R bit: SET(RSP) P/F bit: CLR N(R): 109 N(S): 7

Q.931 Type: Connect-Ack  
CALL REFERENCE:  
Len = 2 Value = 16213 Flag = [0] (ORG)

Tenor sends to the PBX interface  
(1) a connect acknowledgement.

Q9XX :453617366:RECV[1]  
SAPI: 0 TEI: 0 Frame: RR  
C/R bit: SET(CMD) P/F bit: CLR N(R): 8

Q9XX :453618010:XMIT[1]  
SAPI: 0 TEI: 0 Frame: I  
C/R bit: SET(RSP) P/F bit: CLR N(R): 109 N(S): 8

Q.931 Type: Disconnect  
CALL REFERENCE:  
Len = 2 Value = 16213 Flag = [0] (ORG)  
CAUSE IE:  
Coding Standard: CCITT  
Location: Local Network  
Cause Value: Normal clearing (16)

Tenor sends to the PBX interface  
(1) a disconnect (call was  
terminated from the other end)  
with a cause of Normal Clearing.

Q9XX :453618016:RECV[1]  
SAPI: 0 TEI: 0 Frame: I  
C/R bit: CLR(RSP) P/F bit: CLR N(R): 9 N(S): 109

Q.931 Type: Release  
CALL REFERENCE:  
Len = 2 Value = 16213 Flag = [1] (DEST)

Tenor receives from the PBX  
interface (1) a release.

Q9XX :453618016:XMIT[1]  
SAPI: 0 TEI: 0 Frame: RR  
C/R bit: CLR(CMD) P/F bit: CLR N(R): 110

Q9XX :453618016:XMIT[1]  
SAPI: 0 TEI: 0 Frame: I  
C/R bit: SET(RSP) P/F bit: CLR N(R): 110 N(S): 9

Q.931 Type: Release-Complete  
CALL REFERENCE:  
Len = 2 Value = 16213 Flag = [0] (ORG)

Tenor sends to the PBX interface  
(1) a release complete.

## TON/NPI Brief Explanation

The TON and NPI are used in ISDN and H323 to identify the type of number that was dialed. There are several types and they have different meanings. The most common are:

| NPI |         | TON |                    |
|-----|---------|-----|--------------------|
| 0   | Unknown | 0   | Unknown            |
| 1   | ISDN    | 1   | International      |
| 9   | Private | 2   | National           |
|     |         | 4   | Subscriber (Local) |

### ***NPI (Numbering Plan ID)***

The NPI defines whether the number is a public number, private number, or unknown. When it is set to a Public/ISDN number (1), then this number must adhere to the E.164 format of numbers. This means that, depending on the TON setting, it will be made up of a country code, city/area code, and a local number. See the TON description below for more on this. Public numbers can be routed on the public voice network. Examples of public numbers are 4609000 (local number), 17324609000 (international format number).

When the NPI is set to 9 for Private, then the number does not need to adhere to any rules. A private number is typically used between 2 locations. When you have 3 or 4 digit dialing between offices, this would be a private number. A private number cannot be used on the public voice network, only a private network. Examples of private numbers are 250, 6500.

Finally, when the NPI is set to 0 for unknown, it is not known if the number is public or private. Typically, the public voice network treats this as a public call and subjects the dialed numbers to the rules of public numbers. The Tenor also treats unknown numbers as public.

### ***TON (Type of Number)***

This is sometimes called TOA or Type of Address. This specifies the type of number.

When the TON is set for 1 for international, then the number should be delivered in the full international format of country code + area code + local number. Typically, the international prefix is not sent because setting the TON to 1 would tell the destination switch that this is an international call and the international prefix is not necessary. Check with your carrier for more information on this. Examples of numbers with a TON of 1 are 4416155554646 (44 is the country code, 161 is the city/area code, 55554646 is the local number), 17324609000 (1 is the country code, 732 is the area code, 4609000 is the local number).

When the TON is set to 2 for National, then the number should be in the national format which is just the city/area code and the local number. Typically, the long distance prefix is not necessary because when you set the TON to National, you are already telling the destination switch that it is a long distance number, but check with your provider on this. Examples of national format numbers are; 16155554646 (161 is the city/area code, 55554646 is the local number), 7324609000 (732 is the area code, 4609000 is the local number).

When the TON is set to 4 for subscriber, then the number is only the local number format with no area code and no country code. Examples of this are 55554646 and 4609000.

When the TON is set to 0 for Unknown, it is of unknown format. Typically, the public voice network will treat an unknown TON as a subscriber number. Additionally, a switch or PBX may dial a number of 011441615554646 as a TON of 0, and this should be passed through to the PSTN provider as such. When this happens, the PSTN will look at the leading digits to determine the type of number dialed. For example, the above begins with 011, which is the international prefix for the U.S. so the PSTN will know that this is an international number.

### Tenor Number Parsing

When a call is received by the Tenor, based on the dialed digits and the NPI/TON, the Tenor does different things to build out the number and look for a route. Refer to the chart below to see what the Tenor will do to a number based on this information. Also, the NPI and TON values are sent over IP, so the Tenor will do the same for calls coming from IP.

| NPI Value   | TON Value         | What Tenor will do with incoming number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 (ISDN)    | 1 (international) | Tenor does not change the number. It is believed to be a public number in the International (E.164 format).                                                                                                                                                                                                                                                                                                                                                                                                              |
| 1 (ISDN)    | 2 (national)      | Tenor adds the configured country code to the beginning of the number to make it an international format number.                                                                                                                                                                                                                                                                                                                                                                                                         |
| 1 (ISDN)    | 4 (subscriber)    | Tenor adds both the configured country code and area code to the front of the number to build an international number.                                                                                                                                                                                                                                                                                                                                                                                                   |
| 1 (ISDN)    | 0 (Unknown)       | Tenor believes the number is a subscriber number and adds both the configured country code and area code to the front of the number.                                                                                                                                                                                                                                                                                                                                                                                     |
| 9 (Private) | 0 (Unknown)       | Because the NPI is Private, the Tenor does not change the number at all, but routes it as a private number.                                                                                                                                                                                                                                                                                                                                                                                                              |
| 9 (Private) | 1 (international) | Because the NPI is Private, the Tenor does not change the number at all, but routes it as a private number.                                                                                                                                                                                                                                                                                                                                                                                                              |
| 9 (Private) | 2 (national)      | Because the NPI is Private, the Tenor does not change the number at all, but routes it as a private number.                                                                                                                                                                                                                                                                                                                                                                                                              |
| 9 (Private) | 4 (subscriber)    | Because the NPI is Private, the Tenor does not change the number at all, but routes it as a private number.                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0 (Unknown) | 0 (Unknown)       | Tenor looks at the beginning of the number. If it begins with a configured international prefix, then the Tenor deletes the international prefix and leaves the rest of the number. If the number begins with a configured long distance prefix, the Tenor deletes the prefix and adds the configured country code to the beginning of the number. If the number does not begin with either the international prefix or the long distance prefix, then the Tenor adds both the country code and area code to the number. |
| 0 (Unknown) | 1 (international) | Tenor does not change the number. It is believed to be a public number in the International (E.164 format).                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0 (Unknown) | 2 (national)      | Tenor adds the configured country code to the beginning of the number to make it an international format number.                                                                                                                                                                                                                                                                                                                                                                                                         |
| 0 (Unknown) | 4 (subscriber)    | Tenor adds both the configured country code and area code to the front of the number to build an international number.                                                                                                                                                                                                                                                                                                                                                                                                   |

For more information, please refer to the Tenor routing document located on our web site.