

E1 R2 Signaling for the Cisco 3620 and 3640 Series Routers

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Feature Summary

R2 signaling is an international signaling standard that is common to channelized E1 networks, however, there is no single signaling standard for R2. The ITU-T Q.400-Q.490 recommendation defines R2, but a number of countries and geographic regions implement R2 in entirely different ways. Cisco Systems addresses this challenge by supporting many localized implementations of R2 signaling in its Cisco IOS software.

Cisco System's E1 R2 signaling default is ITU, which supports the following countries: Denmark, Finland, Germany, Russia (ITU variant), Hong Kong (ITU variant), and South Africa (ITU variant). The expression "ITU variant" means there are multiple R2 signaling types in the specified country, but Cisco supports the ITU variant.

Cisco Systems also supports specific local variants of E1 R2 signaling in the following regions, countries, and corporations:

- Argentina
- Australia
- Bolivia
- Brazil
- Bulgaria
- China
- Columbia

Feature Summary

- Costa Rica
- East Europe (includes Croatia, Russia, and Slovak Republic)
- Ecuador ITU
- Ecuador LME
- Greece
- Guatemala
- Hong Kong (uses the China variant)
- Indonesia
- Israel
- Laos
- Korea
- Malaysia
- Malta
- New Zealand
- Paraguay
- Peru
- Philippines
- Saudi Arabia
- Singapore
- South Africa (Panaftel variant)
- Telmex corporation (Mexico)
- Telnor corporation (Mexico)
- Thailand
- Uruguay
- Venezuela
- Vietnam

Note Only MICA digital modem modules support R2 functionality. No R2 support is provided for Microcom modems or non-modem applications.

Benefits

Customizing E1 characteristics for R2 has the following benefits:

- R2 custom localization—R2 signaling is supported for a wide range of countries and geographical regions. Cisco is continually supporting new countries.
- Broader deployment of dial access services.

Platforms

These modular access routers support this feature:

- Cisco 3620 router
- Cisco 3640 router

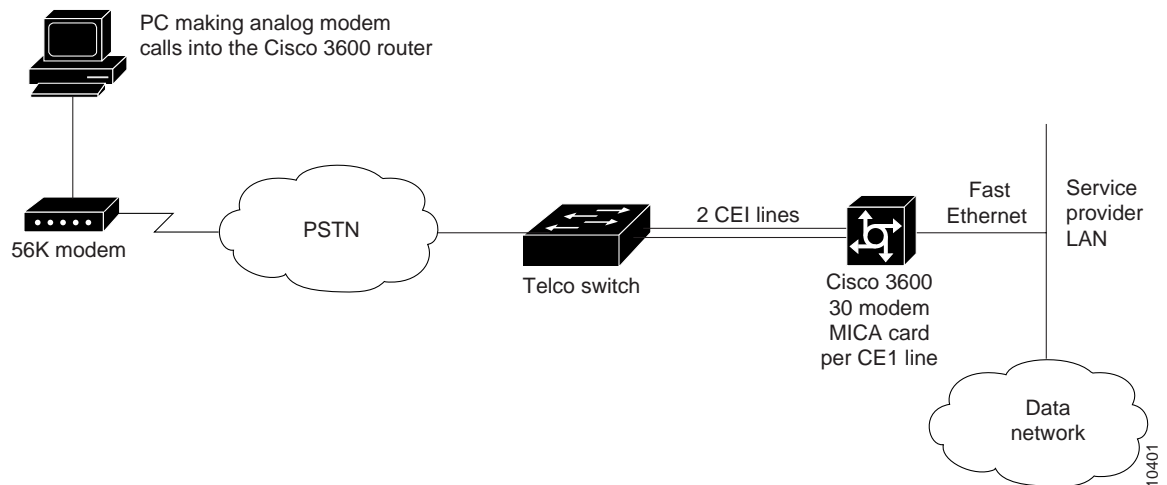
Supported MIBs and RFCs

None.

Sample Network Topology

Figure 1 shows a sample network topology for using E1 R2 signaling with a Cisco 3600. Both controllers on the router are configured with R2 digital signaling. Additionally, localized R2 country settings are enabled on the router. For a sample configuration, see the “Configuration Example” section on page 7.

Figure 1 Service Provider using E1 R2 Signaling and a Cisco 3640



Configuring E1 R2 Signaling

R2 is a channelized E1 signaling used in Europe, Asia, and South America. It is equivalent to channelized T1 signaling in North America. There are two types of R2 signaling: line signaling and interregister signaling. R2 line signaling includes R2 digital, R2 analog, and R2 pulse. R2 interregister signaling includes R2 compelled, R2 non compelled, and R2 semi compelled. These signaling types are configured using the **cas-group (controller e1)** command.

Many countries and regions have their own E1 R2 variant specifications, which supplement the ITU-T Q.400-Q.490 recommendation for R2 signaling. Unique E1 R2 signaling parameters for specific countries and regions are set by entering the **cas-custom channel** command followed by the **country name** command.

Configuring E1 R2 Signaling

Cisco's implementation of R2 signaling has DNIS support turned on by default. If you enable the **ani** option, the collection of DNIS information is still performed. Specifying the **ani** option does not disable DNIS collection. DNIS is the number being called. ANI is the caller's number. For example, if you are configuring router A to call router B, then the DNIS number is assigned to router B, and the ANI number is assigned to router A. ANI is similar to Caller ID.

Configure

Step	Command	Purpose
1	Router(config)# configure t	Enter global configuration to configure E1 R2 for your Cisco 3620 or 3640 router.
2	Router(config-controller)# controller e1 slot/port	Specify the E1 controller that you want to configure with R2 signaling.
3	Router(config-controller)# cas-group channel timeslots range type { r2-analog r2-digital r2-pulse } { r2-compelled [ani] r2-non-compelled [ani] r2-semi-compelled [ani]}	Configure R2 channel associated signaling on the E1 controller. For a complete description of the available R2 options, see the cas-group (controller e1) on page 17.
4	Router(config-controller)# cas-custom channel	Enter cas-custom mode. In this mode, you can localize E1 R2 signaling parameters, such as specific R2 country settings for Hong Kong. For the customization to take effect, the <i>channel</i> number used in the cas-custom command must match the <i>channel</i> number specified by the cas-group command.
5	Router(config-ctrl-cas)# country name use-defaults	Specify the local country, region, or corporation specification to use with R2 signaling. Replace the <i>name</i> variable with one of the supported country names. Cisco strongly recommends that you include the use-defaults option, which engages the default settings for a specific country. The default setting for all countries is ITU. See cas-custom on page 11 for the list of supported countries, regions, and corporation specifications.
6	Router(config-ctrl-cas)# ani-digits Router(config-ctrl-cas)# answer-signal Router(config-ctrl-cas)# caller-digits Router(config-ctrl-cas)# category Router(config-ctrl-cas)# default Router(config-ctrl-cas)# dnis-digits Router(config-ctrl-cas)# invert-abcd Router(config-ctrl-cas)# ka Router(config-ctrl-cas)# kd Router(config-ctrl-cas)# metering Router(config-ctrl-cas)# nc-congestion Router(config-ctrl-cas)# unused-abcd Router(config-ctrl-cas)# request-category	(Optional) Further customize the R2 signaling parameters. Some switch types require you to fine tune your R2 settings. Do not tamper with these commands unless you fully understand your switch's requirements. For nearly all network scenarios, the country name use-defaults command fully configures your country's local settings. You should not need to perform Step 5. See the cas-custom command reference page for more information about each signaling command.

For another E1 R2 configuration example, see "Configuration Example" on page 7.

Verify

To verify the E1 R2 signaling configuration:

- Enter the **show controller e1** command to view the status for all controllers, or enter the **show controller e1 slot/port** command to view the status for a particular controller. Make sure the status indicates the controller is up (line 2 in the following example) and no alarms (line 4 in the following example) or errors (lines 9 and 10 in the following example) have been reported.

```
Router# show controller e1
E1 1/0 is down.
  Applique type is Channelized E1 - balanced
  Transmitter is sending remote alarm.
  Receiver is getting AIS.
  Framing is CRC4, Line Code is HDB3, Clock Source is Line.
  Data in current interval (730 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 730 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 730 Unavail Secs
  Total Data (last 24 hours)
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 21740 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 21740 Unavail Secs
E1 1/1 is up.
  Applique type is Channelized E1 - balanced
  No alarms detected.
  Framing is CRC4, Line Code is HDB3, Clock Source is Line.
  Data in current interval (731 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Total Data (last 24 hours)
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

- Enter the **show modem csm** command to view status for a specific modem:

```
Router# show modem csm 3/0
Modem 3/0, line 97 (digital)
CSM status(0): CSM_STATUS_UNLOCKED
CSM current state(0x00000000): IDLE_STATE
CSM last event: ASYNC_DTR_UP, cause: 0x0000
wdt timer is not activated
invalid_events 0, wdt_timeouts 0
ic_failure 0, ic_complete 0, oc_failure 7, oc_complete 0
oc_busy 0, remote_link_disc 2, busyout 0, modem_reset 1
call started 23:56:54, call ended 23:59:26, total modem active time 00:06:14
tty_hwidb 0x61443C94, modem_tty 0x61442680, modem_pool 0x6129E358
total pri d-channels 0, last used pri d-channel 0
total_free_rbs_timeslot 0, total_busy_rbs_timeslot 0, min_free_modem_threshold 6
```

Troubleshoot

If the connection does not come up, check the following:

- Loose wires, splices, connectors, shorts, bridge taps, and grounds
- Backwards transmit and receive
- Mismatched framing types (for example, CRC-4 verses no-CRC-4)
- Transmit and receive pair separation (crosstalk)
- Faulty line cards or repeaters
- Noisy lines (for example, power and crosstalk)

If you see errors on the line or the line is going up and down, check the following:

- Mismatched line codes (HDB3 vs. AMI)
- Receive level
- Frame slips due to poor clocking plan

If you are still having trouble, enable the modem management Call Switching Module (CSM) debug mode using the **debug modem csm** command.

This is the debug output for an incoming call:

```
Router# debug modem csm 1/0
Modem Management Call Switching Module debugging is on
R2D2#
*Feb 28 19:01:47: Modem 255/255 CSM: received EVENT_CALL_DIAL_IN with call_id 0000
*Feb 28 19:01:47:      src 1/0/0 dest 255/0/255 cause 768
*Feb 28 19:01:47: CSM: Next free modem = 3/18; statbits = 10020
*Feb 28 19:01:47: Modem 3/18 CSM: modem is allocated, modems free=29
*Feb 28 19:01:47: Modem 3/18 CSM: (CSM_PROC_IDLE)<--DSX0_CALL
*Feb 28 19:01:47: Modem 3/18 CSM:
(CSM_PROC_IC_CAS_CHANNEL_LOCKED)<--CSM_EVENT_MODEM_SETUP
*Feb 28 19:01:47: R2 Incoming Modem(3/18): DSX (E1 1/0:0): STATE: R2_IN_IDLE R2 Got
Event R2_START
*Feb 28 19:01:47: Modem 3/18 CSM: received EVENT_START_RX_TONE with call_id 0000
*Feb 28 19:01:47:      src 1/0/0 dest 3/0/18 cause 0
*Feb 28 19:01:47: Modem 3/18 CSM: (CSM_PROC_IC_CAS_COLLECT_DIGITS)<--DSX0_START_RX_TONE
.
.
.
```

When the E1 controller comes up, you will see the following messages:

```
%CONTROLLER-3-UPDOWN: Controller E1 0, changed state to up
It also shows these messages for individual timeslots:
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 1 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 2 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 3 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 4 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 5 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 6 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 7 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 8 is up
.
.
.
```

Configuration Example

The following example configures R2 signaling and customizes R2 parameters on controller E1 1/0 of a Cisco 3640. In most cases, the same R2 signaling type is configured on each E1 controller.

Step 1 Enter global configuration mode using the **configure terminal** command:

```
Router# configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.
```

Step 2 Specify the E1 controller that you want to configure with R2 signaling using the **controller e1 slot/port** global configuration command. A controller informs the router how to distribute or provision individual timeslots for a connected channelized E1 line. You must configure one E1 controller for each E1 line.

```
Router(config)# controller e1 1/0
```

Step 3 Configure channel associated signaling with the **cas-group channel timeslots range type signal** command. The signaling type forwarded by the connecting telco switch must match the signaling configured on the Cisco 3640. The Cisco IOS configuration options are **r2-analog**, **r2-digital**, or **r2-pulse**.

```
Router(config-controller)# cas-group 1 timeslots 1-31 type ?  
r2-analog          R2 ITU Q411  
r2-digital         R2 ITU Q421  
r2-pulse          R2 ITU Supplement 7
```

The following example specifies R2 ITU Q421 digital line signaling (**r2-digital**). This example also specifies R2 compelled register signaling and provisions the ANI ADDR option.

```
Router(config-controller)# cas-group 1 timeslots 1-31 type r2-digital  
r2-compelled ani  
Router(config-controller)#  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 1 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 2 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 3 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 4 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 5 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 6 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 7 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 8 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 9 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 10 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 11 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 12 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 13 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 14 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 15 is up  
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 17 is up
```

Configuration Example

```

%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 18 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 19 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 20 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 21 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 22 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 23 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 24 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 25 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 26 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 27 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 28 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 29 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 30 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 31 is up

```

Note For a description of the supported R2 signaling options, see the **cas-group (controller e1)** command reference page. The actual R2 channel associated signaling is configured on the 16th timeslot, which is why the timeslot does not come up in the example output.

- Step 4** Customize some of the E1 R2 signaling parameters with the **cas-custom channel** controller configuration command. This example specifies the default R2 settings for Argentina. See the **cas-custom** command reference page for a detailed description of these options.

```

Router(config-controller)# cas-custom 1
Router(config-ctrl-cas)# ?
CAS custom commands:
  ani-digits      Expected number of ANI digits
  answer-signal  Answer signal to be used
  caller-digits  Digits to be collected before requesting CallerID
  category       Category signal
  country        Country Name
  default        Set a command to its defaults
  dnis-digits    Expected number of DNIS digits
  exit           Exit from cas custom mode
  invert-abcd    invert the ABCD bits before tx and after rx
  ka             KA Signal
  kd             KD Signal
  metering       R2 network is sending metering signal
  nc-congestion  Non Compelled Congestion signal
  no            Negate a command or set its defaults
  request-category DNIS digits to be collected before requesting category
  unused-abcd    Unused ABCD bit values

```

```
Router(config-ctrl-cas)# country ?
  argentina      Argentina
  australia      Australia
  brazil         Brazil
  china          China
  columbia       Columbia
----cut----
Router(config-ctrl-cas)# country argentina ?
  use-defaults   Use Country defaults
  <cr>

Router(config-ctrl-cas)# country argentina use-defaults
```

Note Cisco strongly recommends that you specify your country's default settings. To display a list of supported countries, enter the **country ?** command. The default setting for all countries is ITU.

Command Reference

This section documents new and modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.0(2)T command references.

- **cas-custom**
- **cas-group (controller e1)**

cas-custom

To customize E1 R2 signaling parameters for a particular E1 channel group on a channelized E1 line, use the **cas-custom** controller configuration command. Use the **no** form of this command to disable the signaling customization.

```
cas-custom channel
no cas-custom channel
```

Syntax Description

<i>channel</i>	Specifies a single channel group number, which can be from 0 and 30. This channel group number must match the channel number specified in the cas-group command.
----------------	---

Default

No customized signaling parameters are set. If you do not specify a country name using the **country name** command, which is described in Table 1, ITU is the selected default signal.

Command Mode

Controller configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 12.0(1)T for the Cisco 3600 series routers.

The customization parameters set by the **cas-custom channel** command are applied to the same channel group number used in the **cas-group channel timeslots range type signal** command. These channel group numbers must match. Otherwise, the customized features specified by the **cas-custom** command will not be applied to the **cas-group** command's configuration. The signaling customization will not take effect. See Example 1.

However, you will not need to configure or set more than one channel group number per E1 line in most cases. Though rarely used, it is possible to split a single E1 (timeslots 1 to 31) into multiple groups (for example, 1 to 15 on group 1 and timeslots 17 to 31 in group 2).

Cisco strongly recommends that you use the **use-defaults** option when specifying a particular country type. See the **country name** command in Table 1. This additional keyword ensures that all the local country settings are correctly enabled. For example, enter the **country greece use-defaults** command. If the **use-defaults** option is not specified, generic ITU will be the default setting for all countries. See Example 2.

You can configure the system to deviate from a country's default settings as defined by Cisco. To do this, choose from the following list of commands described in Table 1: **ani-digits min number max number**, **answer-signal {group-a | group-b} number**, **caller-digits number**, **category number**, **dnis-digits min number max number**, **invert-abcd**, **ka number**, **kd number**, **metering**, **nc-congestion**, and **unused-abcd value**. To return a country back to its country-specific default settings, enter the **country name use-defaults** command. To return a country back to the ITU standard, enter the **default country name use-defaults** command. See Example 3 and Example 4.

Note Only integrated MICA digital modems support E1 R2 signaling on Cisco 3620 and 2640 series routers.

Table 1 shows a list of command options in cas-custom mode, which is used to customize R2 signaling settings. Some switches require you to fine tune your R2 settings. Do not tamper with these commands unless you understand exactly how your switch will be effected.

Table 1 Available Commands in Cas-Custom Mode

CAS Custom Command	Purpose
ani-digits <i>min number max number</i>	Requested number of ANI digits for each call. All calls that do not match the minimum and maximum settings that you specify will be dropped. The minimum number of collected digits is set by min number . Replace the <i>number</i> variable with a value from 0 and 64. The maximum number of collected digits is set by max number . Replace the <i>number</i> variable with a value from 5 and 64. By default, ANI digits are not collected, which is the ITU standard.
answer-signal { group-a group-b } <i>number</i>	Answer signal to be used. You can specify the group A signal or the group B signal. The signal <i>number</i> can be from 1 to 15. The default is group B is 6, which is the ITU default.
caller-digits <i>number</i>	Specifies the number of digits the router needs to collect before it requests ANI or CallerID information. The digits can be from 1 to 10. The default is 1, which is the ITU default.
category <i>number</i>	Specifies the category type of the incoming call, which is mapped to a group signal <i>number</i> . Signal numbers from 1 to 15 are available. The default is 1, which is the ITU default.
country <i>name use-defaults</i>	Specifies the local country, regional, and some corporation settings for R2 signaling. Replace the <i>name</i> variable with one of the following supported country names. Cisco strongly recommends that you include the use-defaults option, which enables the default settings for a specific country. The default country setting is ITU. <ul style="list-style-type: none"> • argentina use-defaults • australia use-defaults • bolivia use-defaults • brazil use-defaults • bulgaria use-defaults • china use-defaults • columbia use-defaults • costarica use-defaults • easteurope use-defaults—The easteurope option supports Croatia, Russia, and the Slovak Republic. • ecuador-itu use-defaults • ecuador-lme use-defaults • greece use-defaults • guatemala use-defaults • hongkong-china use-defaults— The Hong Kong options uses the China variant.

Table 1 Available Commands in Cas-Custom Mode (Continued)

CAS Custom Command	Purpose
	<ul style="list-style-type: none"> • indonesia use-defaults • israel use-defaults • itu—ITU is the signaling default. ITU provides support for the following list of countries: Denmark, Finland, Germany, Russia (ITU variant), Hong Kong (ITU variant), and South Africa (ITU variant). The expression “ITU variant” means that there are multiple R2 signaling types deployed in the specified country, but Cisco supports the ITU variant. • korea use-defaults • laos use-defaults • malaysia use-defaults • malta use-defaults • newzealand use-defaults • paraguay use-defaults • peru use-defaults • philippines use-defaults • saudi-arabia use-defaults • singapore use-defaults • south-africa-panaf-tel use-defaults—The South Africa option uses the Panaf-tel variant. • telmex use-defaults • telnor use-defaults—The Telemex and Telnor corporations are supported for Mexico. • thailand use-defaults • uruguay use-defaults • venezuela use-defaults • vietnam use-defaults
default	Sets a command to its default setting.
debounce-time <i>number</i>	Validates ABCD bit changes. If ABCD bit value changes are shorter than debounce time (in milliseconds), then bit changes are invalid. The value entered here must equal the total for all timers. For example, to achieve a seizure-ack-time of 40, configure debounce-time to 20 and seizure-ack-time to 20.
dnis-digits min <i>number</i> max <i>number</i>	Requested number of DNIS digits for each call. All calls that do not match the minimum and maximum settings that you specify will be dropped. The minimum number of collected digits is set by min <i>number</i> . Replace the <i>number</i> variable with a value from 0 and 64. The maximum number of collected digits is set by max <i>number</i> . Replace the <i>number</i> variable with a value from 5 and 64. By default, DNIS digits are not collected, which is the ITU standard.
exit	Takes you out of cas-custom mode.
invert-abcd	Inverts the ABCD bits before tx and after rx. This feature is disabled by default, which is the ITU default.

Table 1 Available Commands in Cas-Custom Mode (Continued)

CAS Custom Command	Purpose
ka <i>number</i>	Specifies the KA signal code. Replace the number variable with a value from 1 to 15. The default is 0, which is the ITU default.
kd <i>number</i>	Specifies the KD signal code. Replace the number variable with a value from 1 to 15. The default is 0, which is the ITU default.
metering	Allows the router to correctly handle a metering signal sent by the R2 network. Metering is turned off by default, which is the ITU default.
nc-congestion	Specifies the noncompelled congestion signal. This signal is sent to the central office when the router is congested and cannot accept the call. The default is B4, which is the ITU default.
no	Negates a command or sets its defaults.
release-guard-time <i>number</i>	The time difference in milliseconds between receiving the idle signal and transmitting the idle signal. The count begins once the router receives a clear forward(idle) signal. The release-guard-time command follows the disconnect request for successful calls only.
request-category	DNIS digits to be collected before requesting category. A category specifies different priority levels for different calls within R2, such as data calls verses voice calls. This information is primarily used for the switches that forward the calls to the NAS. For example, India needs the category requested after the first DNIS digit.
seisure-ack-time <i>number</i>	The time difference between the seizure signal and the seizure acknowledgement signal. Used to specify how long the router must wait before transmitting a seizure acknowledgement signal after receiving the seizure signal. Specific to R2 signaling only.
unused-abcd <i>value</i>	Specifies unused ABCD bit values, which can have a 0 or 1 bit value. This feature is disabled by default, which is the ITU default.

Example 1

The following example displays the available signaling parameters after you enter cas-custom mode. Notice that the same channel group 1 is specified in the **cas-group** command and the **cas-custom** command.

```

Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z
router(config)# controller e1 1/0
router(config-controller) cas-group 1 timeslots 1-31 type r2-digital r2-compelled
router(config-controller) cas-custom 1
router(config-ctrl-cas)# ?
CAS custom commands:
  ani-digits           Expected number of ANI digits
  answer-signal       Answer signal to be used
  caller-digits       Digits to be collected before requesting CallerID
  category            Category signal
  country             Country Name
  debounce-time       Debounce Timer
  default             Set a command to its defaults
  dnis-digits         Expected number of DNIS digits
  exit               Exit from cas custom mode
  invert-abcd         invert the ABCD bits before tx and after rx
  ka                 KA Signal

```

kd	KD Signal
metering	R2 network is sending metering signal
nc-congestion	Non Compelled Congestion signal
no	Negate a command or set its defaults
release-guard-time	Release Guard Timer
request-category	DNIS Digits to be collected before requesting category
seizure-ack-time	Seizure to Acknowledge timer
unused-abcd	Unused ABCD bit values

Example 2

You can localize your R2 configuration for a specific country. Do not forget to include the **use-defaults** option as described in Table 1. For example, use the **country argentina use-defaults** command for a R2 scenario in Argentina.

```

Router(config-ctrl-cas)# country ?
  argentina      Argentina
  australia      Australia
  bolivia        Bolivia
  brazil         Brazil
  bulgaria       Bulgaria
  china          China
  columbia       Columbia
  costarica      Costa Rica
  easteurope     East Europe
  ecuador-itu    Ecuador ITU
  ecuador-lme    Ecuador LME
  greece         Greece
  guatemala      Guatemala
  hongkong-china Hong Kong (China variant)
  indonesia      Indonesia
  israel         Israel
  itu            ITU
  lao            Laos
  korea          Korea
  malaysia       Malaysia
  malta          Malta
  newzealand     New Zealand
  paraguay       Paraguay
  peru           Peru
  philippines    Philippines
  saudiarabia    Saudi Arabia
  singapore      Singapore
  southafrica-panaftel South Africa Panaftel
  telmex         Telmex
  telnor         Telnor
  thailand       Thailand
  uruguay        Uruguay
  venezuela      Venezuela
  vietnam        Vietnam

Router(config-ctrl-cas)# country argentina ?
  use-defaults   Use Country defaults
  <cr>

Router(config-ctrl-cas)# country argentina use-defaults

```

Command Reference

Example 3

The following example customizes the signaling for channel group 1. The configuration collects 3 digits before it requests ANI information for analog calls received on a Cisco 3640 in Argentina.

```
Router(config-controller)# cas-custom 1
Router(config-ctrl-cas)# country argentina use-defaults
Router(config-ctrl-cas)# caller-digits 3
Router(config-ctrl-cas)# exit
Router(config-controller)# ^z
Router(config)#
```

Example 4

Because `cas-custom` mode gives you the flexibility to customize R2 parameters, the margin for user error increases. Therefore, the Cisco IOS software enables you to return a country back to its default R2 settings using the `use-defaults` option. The following example begins by bringing up Argentina's default settings, changing a few customization parameters, and then returning the Argentina R2 setting back to its original state.

```
Router(config-ctrl-cas)# country argentina use-defaults
Router(config-ctrl-cas)# caller-digits 3
Router(config-ctrl-cas)# unused-abcd 1
Router(config-ctrl-cas)# metering
Router(config-ctrl-cas)# country argentina use-defaults
```

Related Command

cas-group (controller E1)

cas-group (controller e1)

To configure R2 signaling on an E1 controller, use the **cas-group** controller configuration command.

```
cas-group channel timeslots range type signal
no cas-group channel timeslots range type signal
```

Syntax Description

<i>channel</i>	Specifies a single channel group number. Replace the <i>channel</i> variable with a number from 0 and 30.
timeslots <i>range</i>	Specifies a timeslot range, which can be from 1 to 31. You can specify a timeslot range (for example, 1-31), individual timeslots separated by commas (for example 1, 3, 5), or a combination of the two (for example, 1-14, 15, 17-31). The 16th time slot is reserved for out-of-band signaling.
type <i>signal</i>	Specifies the type of channel-associated signaling. Configure the signal type that your central office uses. Replace the <i>signal</i> variable with one of the following signal types: <ul style="list-style-type: none"> • r2-analog { r2-compelled [ani] r2-non-compelled [ani] r2-semi-compelled [ani] } • r2-digital { r2-compelled [ani] r2-non-compelled [ani] r2-semi-compelled [ani] } • r2-pulse { r2-compelled [ani] r2-non-compelled [ani] r2-semi-compelled [ani] }

The following descriptions are provided for the previous three R2 syntax bullets:

r2-analog—Specifies R2 ITU Q411 analog line signaling, which reflects the on/off switching of a tone in frequency-division multiplexing circuits (before TDM circuits were created). The tone is used for line signaling.

r2-digital—Specifies R2 ITU Q421 digital line signaling, which is the most common signaling configuration. The A and B bits are used for line signaling.

r2-pulse—Specifies R2 ITU supplement 7 pulse line signaling, which is a transmitted pulse that indicates a change in the line state.

r2-compelled [ani]—Specifies R2 compelled register signaling. You can also specify provisioning the ANI addr option.

r2-non-compelled [ani]—Specifies R2 noncompelled register signaling.

r2-semi-compelled [ani]—Specifies R2 semicompelled register signaling.

Default

No channel-associated signaling is configured on the controller. All R2 signaling types have DNIS turned on by default.

Command Mode

Controller configuration

Command Reference

Usage Guidelines

This command first appeared in Cisco IOS Release 12.0(1)T for the Cisco 3600 Series.

Use this command to configure support for incoming and outgoing call signals (such as on-hook and off-hook) on each E1 controller.

If you specify the timeslot range 1-31, the system software automatically uses the 16th timeslot to transmit the channel-associated signaling.

The signaling you configure on the router must match the signaling used by the central office. For example, if the central office switch is forwarding R2 analog signaling to a Cisco 3640, the router's E1 controller must also be configured for R2 analog signaling (**r2-analog**).

All R2 signaling options have DNIS support turned on by default. If you enable the **ani** option, the collection of DNIS information is still performed. Specifying the **ani** option does not disable DNIS. DNIS is the number being called; ANI is the caller's number. For example, if you are configuring router A to call router B, then the DNIS number is router B, and the ANI number is router A. ANI is very similar to Caller ID.

To customize the R2 signaling parameters, refer to the **cas-custom** controller configuration command. When you enable the **cas-group** command, the **cas-custom** command is automatically set up to be polled for configuration information. However, unless you enable or turn on specific features with the **cas-custom** command, the **cas-custom** feature has an empty set of signaling parameters.

Note Only integrated MICA digital modems support E1 R2 signaling on Cisco series routers.

DNIS is automatically collected for R2 tone signaling. You do not need to specify the collection of DNIS information with the **cas-group** command.

Examples

In most cases, you will configure the same channel associated signaling on each E1 controller. The following examples configure signaling and customized parameters on controller E1 R2 using the **cas-group** and **cas-custom** controller configuration commands.

The actual channel-associated signaling is configured on the 16th timeslot, which is why this timeslot does not come up in the following output.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# controller e1 2
Router(config-controller)# cas-group 1 timeslots 1-31 type r2-digital r2-compelled ani
Router(config-controller)#
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 1 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 2 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 3 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 4 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 5 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 6 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 7 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 8 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 9 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 10 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 11 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 12 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 13 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 14 is up
```

```

%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 15 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 17 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 18 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 19 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 20 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 21 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 22 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 23 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 24 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 25 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 26 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 27 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 28 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 29 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 30 is up
%DSX0-5-RBSLINEUP: RBS of controller 0 timeslot 31 is up

```

The following example shows all the supported E1 signaling types on a Cisco 3640.

```

Router(config-controller)# cas-group 1 timeslots 1-31 type ?
  r2-analog          R2 ITU Q411
  r2-digital         R2 ITU Q421
  r2-pulse           R2 ITU Supplement 7

Router(config-controller)# cas-group 1 timeslots 1-31 type r2-analog ?
  r2-compelled      R2 Compelled Register signaling
  r2-non-compelled  R2 Non Compelled Register signaling
  r2-semi-compelled R2 Semi Compelled Register signaling
  <cr>

```

R2 signaling parameters can be customized with the **cas-custom** controller configuration command:

```

Router(config-controller)# cas-custom 1
Router(config-ctrl-cas)# ?
CAS custom commands:
  ani-digits          Expected number of ANI digits
  answer-signal       Answer signal to be used
  caller-digits       Digits to be collected before requesting CallerID
  category            Category signal
  country             Country Name
  debounce-time       Debounce Timer
  default             Set a command to its defaults
  dnis-digits         Expected number of DNIS digits
  exit                Exit from cas custom mode
  invert-abcd         invert the ABCD bits before tx and after rx
  ka                  KA Signal
  kd                  KD Signal
  metering            R2 network is sending metering signal
  nc-congestion       Non Compelled Congestion signal
  no                  Negate a command or set its defaults
  release-guard-time  Release Guard Timer
  request-category    DNIS Digits to be collected before requesting category
  seizure-ack-time    Seizure to Acknowledge timer
  unused-abcd         Unused ABCD bit values

```

What to Do Next

For additional software configuration information, see the following publications:

- *Dial Solutions Configuration Guide (Cisco IOS Release 12.0)*
- *Cisco 3600 Series Hardware Installation Guide*
- *Cisco 3620 Router Installation and Configuration Guide*
- *Cisco 3640 Router Installation and Configuration Guide*
- *Cisco AS5200 Universal Access Server Software Configuration Guide*
- *Update to WAN Interface Cards Hardware Installation Guide*
- *Cisco 3600 Series Configuration Notes*