



## Inpulse and Outpulse Rules

Processing a call on a system network interface circuit requires a number of signaling and supervision actions. These actions are often common among many call types and are performed in the same sequence. After you have defined these sequences, the system stores them and uses them as needed in the form of inpulse and outpulse rules.

Define inpulse and outpulse rules through the system Data Base Administration Menu (refer to the *Cisco VCO/4K System Administrator's Guide*). Actions are represented by tokens; you can use up to 16 tokens in each inpulse and outpulse rule you define.

Rules can be “called” like subroutines in a command or, in the case of inpulse rules, executed by default when an incoming port seizes inward. Because rule processing takes place on the system, the amount of processing overhead for the host computer and the communications links is decreased.

This section presents a summary of inpulse and outpulse rules, focusing on the interaction between rules and the system command/report set. Detailed information on defining and using rules is contained in the *Cisco VCO/4K System Administrator's Guide*.

### Inpulse Rules

An inpulse rule consists of up to 16 tokens. The tokens can be used to condition a trunk to wait for supervision events, collect MF, DTMF, or Dial Pulse (DP) digits, and store received digit fields in an internal system call record. You can define up to 30 inpulse rules.

The system can execute inpulse rules for any line or trunk, regardless of its class of service (COS). An inpulse rule can also specify to execute an outpulse rule. When the outpulse rule has been completed, the original inpulse rule processing continues.

Inpulse rule tokens available in the basic system software are listed in Table 2-1. Available system tones are listed in Appendix E, “Tone Values” (use the decimal values with inpulse rules). The column [xx] indicates if additional data is required to complete a token. Additional tokens for optional system software (TeleRouter, ISDN and ISDN with NFAS) packages are detailed in the documentation that accompanies those options. For a more detailed description of each of the inpulse rules, refer to the *Cisco VCO/4K System Administrator's Guide*.

Inpulse rule tokens are functionally divided into six groups:

- Reporting Control—Determines when change of state and address signaling for an incoming port are reported to the host.
- Signaling Mode—Indicates incoming digits for collection are either MF, DTMF, or DP.
- Digit Collection Setup—Defines the conditions for digit collection.

- Digit Collection—Enables the appropriate receiver (as indicated by the Signaling Mode token) and specifies the digit field in which digits are stored.
- Supervision Control—Presents in-band or out-of-band signaling to the distant end (i.e., answer, wink, tone, voice prompt) or waits a specified length of time before continuing rule processing.
- Processing Control—Allows construction of rules with more than 16 tokens for processing outpulse rules.
- Prompt/Record Control—Prompt and record control for the IPRC.

Table 2-1 Inpulse Rule Token and [xx] Choices

Token	Type	Definition	[xx]
ANSWER	Supervision Control	Seize incoming port (not applicable to SLIC).	—
APEND ANI [xx] <sup>1</sup>	Digit Collection	Collect the number of ANI digits specified in field [xx] and append them to the digits in the call record; [xx] not required for MF.	1 to 40
APEND FLD [xx] <sup>1</sup>	Digit Collection	Append the incoming digits to the call record field specified in field [xx].	1 to 4
CLR CHAR1 [xx]	Digit Collection Setup	For DTMF processing, discard collected digits and restart collection when characters specified in field [xx] are detected.	0 to 9, *, #
		When “4th Column DTMF” is enabled, valid entry includes A to F.	0 to 9, *, #, A to F
		For MFCR2 processing, set the backward supervision tone to send.	0 to 15
CLR CHAR2 [xx]	Digit Collection Setup	For DTMF processing, discard collected digits and restart collection when characters specified in field [xx] are detected.	0 to 9, *, #
		When “4th Column DTMF” is enabled, valid entry includes A to F.	0 to 9, *, #, A to F
CONT NREP	Digit Collection Setup	Continue rule processing if a DTMF/DP first digit, interdigit, or field timeout occurs. Do not report timeout to host. Any digits collected at the end of the rule are reported unless overwritten by subsequent collection.	—
CONT REP	Digit Collection Setup	Continue rule processing if a DTMF/DP first digit, interdigit, or field timeout occurs. Report timeout and all digits collected to host.	—
DIGITS [xx]	Digit Collection Setup	Collect number of digits specified in field [xx]; DTMF, DP, and MFCR2 only.	1 to 40
DO IRULE [xx]	Processing Control	Execute inpulse rule specified in field [xx] and return to next token in this rule.	1 to 30
DO ORULE [xx]	Processing Control	Execute outpulse rule specified in field [xx] and return to next token in this rule.	1 to 30
DTMF	Signaling Mode	Attach DTMF receiver; for DID and SLIC, can be either DTMF or DP collection.	—

Table 2-1 Inpulse Rule Token and [xx] Choices (continued)

Token	Type	Definition	[xx]
DTMF4	Signaling Mode	Allows END CHARx and CLR CHARx tokens data fields to accept fourth column DTMF digits. System feature flag, “Enable 4th Column DTMF” must be enabled to use this token.	—
END CHAR1 [xx]	Digit Collection Setup	For DTMF processing, single end digit collection when characters specified in field [xx] are detected.	0 to 9, *, #
		When “4th Column DTMF” is enabled, valid entry includes A to F.	0 to 9, *, #, A to F
		For MFCR2 processing, set backward supervision tone after digit collection is complete.	0 to 15
END CHAR2 [xx]	Digit Collection Setup	For DTMF processing, double end digit collection when characters in specified field [xx] are detected.	0 to 9, *, #
		When “4th Column DTMF” is enabled, valid entry include A to F.	0 to 9, *, #, A to F
GLARE [xx]	Processing Control	Execute a specified inpulse rule when an ISDN glare condition occurs.	1 to 30
GOTO RULE [xx]	Processing Control	Execute an inpulse rule specified in field [xx] without returning to this rule.	1 to 30
IP ANI [xx] <sup>1</sup>	Digit Collection	Collect the number of ANI digits specified in field [xx] and store in call record; [xx] not required for MF.	1 to 40
IP CAT2	Digit Collection	Allows for a single category digit collection.	—
IP FIELD [xx] <sup>1</sup>	Digit Collection	Store incoming digits in the call record field specified in field [xx].	1 to 4
ISDN RX	Supervision Control	Use an ISDN message template during rule processing.	1 to 96
ISDN TX	Supervision Control	Specify which ISDN message template to use to construct an outgoing D-channel message.	1 to 96
LIBRARY [xx]	Prompt/Record Control	The system supports 16 prompt libraries. Hunt for an IPRC port from the announcement resource group that supports the specified prompt library.	0 to 16 or TMP
LOOP ALL	Prompt/Record Control	Instruct the IPRC to continually loop the prompt list being played. Continue until a subsequent inpulse rule or host command terminates the operation or the IPRC playing the prompt list is removed from the call.	—
LOOP LAST	Prompt/Record Control	Instruct the IPRC to continually loop the last prompt in a list of prompts being played. Continue until a subsequent inpulse rule or host command terminates the operation, or the IPRC port playing the prompt list is removed from the call.	—
MAX REC [xx]	Prompt/Record Control	Define an upper limit in seconds for recording a particular prompt. Default value is 0, meaning no limit.	0 to 255

Table 2-1 Inpulse Rule Token and [xx] Choices (continued)

Token	Type	Definition	[xx]
MF	Signaling Mode	Attach MF receiver.	—
MFCR2	Signaling Mode	Attach MFCR2 transceiver.	—
NO HOST [xx]	Processing Control	Execute a specified inpulse rule setup timer. If no host command is received in that time, the system executes the inpulse rule indicated in the NO HOST [xx] token data field.	1 to 30
NO REP	Reporting Control	Suppress end of rule reporting; no effect on REP EACH or REP NEXT tokens.	—
RECORD [xx]	Prompt/Record Control	Hunt an IPRC containing default or previously defined prompt library. Erase the prompt specified by ID, and begin recording new prompt from the line/trunk port executing the inpulse rule.	1 to 255
RELEASE [xx]	Resource Control	Remove the specified resource type from the call.	IPRC, MRC, DRC, DTG, CPA, or MCR. Data must be typed (case sensitive); it is not selectable.
REP EACH	Reporting Control	Report all inpulsing events to host when they occur.	—
REP END	Reporting Control	Report collected digits, end of rule, and any errors to host when inpulsing is completed (default).	—
REP NEXT	Reporting Control	Report the next inpulsing event to the host, then revert to previous Report Control mode.	—
RETAIN [xx]	Resource Control	Hold on to the specified resource type from the call.	IPRC, DTMF, MCR, and DRC. Data must be typed (case sensitive); it is not selectable.
ROUTE (Tx)	Processing Control	Provides call routing based on the digit stored in the specified digit field. Must be the last token defined in an inpulse rule.	For T: A to J For x: 0 to 5
SPEAK [xx] <sup>1</sup>	Prompt/Record Control	Speak voice prompt specified in field [xx].	1 to 255
STOP VOIC	Prompt/Record Control	Terminate playback or record operation.	—
TIM FDIG [xx]	Digit Collection Setup	Wait the number of seconds specified in field [xx] for the first digit to be received (max. time between receiver enabled and first digit); DTMF, DP only.	1 to 30
TIM FIELD [xx]	Digit Collection Setup	Wait the number of seconds specified in field [xx] for the number of digits minus one specified in DIGITS [xx] to be received; default value is 20, DTMF, DP only.	1 to 60
TIM INTER [xx]	Digit Collection Setup	Wait the number of seconds specified in field [xx] for another digit after one is received (max. time between digits); default value is 6, DTMF, DP only.	1 to 10

Table 2-1 Impulse Rule Token and [xx] Choices (continued)

Token	Type	Definition	[xx]
TONE CLR [xx]	Digit Collection Setup	Send tone specified in field [xx] when CLR CHAR is detected.	0 to 1, 3 to 7, 9 to 63 <sup>2</sup>
TONE ENAB [xx]	Digit Collection Setup	Send tone specified in field [xx] when receiver is enabled.	0 to 1, 3 to 7, 9 to 63 <sup>2</sup>
TONE END [xx]	Digit Collection Setup	Send tone specified in field [xx] when END CHAR is detected.	0 to 1, 3 to 7, 9 to 63 <sup>2</sup>
TONE FDIG [xx]	Digit Collection Setup	Send tone specified in field [xx] when first digit is detected by receiver; DTMF, DP only	0 to 1, 3 to 7, 9 to 63 <sup>2</sup>
TONE NOW [xx]	Supervision Control	Send tone specified in field [xx].	0 to 63 <sup>2</sup>
WAIT TIME [xx] <sup>1</sup>	Supervision Control	Wait the number of seconds specified in field [xx] before continuing rule processing.	1 to 10
WINK ENAB	Digit Collection Setup	Wink trunk when receiver is enabled.	—
WINK NOW	Supervision Control	Condition trunk circuit to Busy for 250 ms (T1, E+M, DID only) or hookflash for 500 ms (UTC only).	—

1. Refer to the “Recursive (Looping) Rules” section on page 2-10 for information on the use of these tokens in recursive rules.
2. Refer to Appendix E, “Tone Values,” for decimal tone values and their corresponding tones.

## Beginning Impulse Rule Processing

Impulse rule processing can begin in one of the following ways:

- Ordered by a host command—An impulse rule can be started by the host with an Outgoing Port Control (\$69) or Incoming Port Control (\$6A) command. The port for which the rule is specified must be off hook. Refer to Chapter 4, “System Commands,” for more information.
- Started by an autonomous event—An impulse rule can be specified as the default rule for an incoming port. When an off hook (seize) is detected on a port with a default rule, impulse rule processing begins.
- Started by an outpulse rule DO IRULE token—An impulse rule can be started by a DO IRULE token in an outpulse rule.

## Ending Impulse Rule Processing

Impulse rule processing ends normally when all instructions in the rule (or rules if GOTO RULE or DO IRULE/ORULE tokens are used) have been executed. Processing is aborted in the following cases:

- Ordered by host command—A resource control command is received that specifies the port involved in impulse rule processing as the controlling port.
- Aborted by error condition—An MF/DTMF receiver or voice port was not available when required by rule processing, garbled MF digits were received or an MF timer expired, an outpulse channel or CPA port was not available (outpulse rule processing via DO ORULE token), or DTMF/DP timer expired (no CONT REP or CONT NREP token in rule).

## Reports Produced by Inpulse Rule Processing

The following reports are produced by inpulse rule processing:

- **MF Digit (\$D0)**—Contains any MF digits collected for a single digit field. Multiple \$D0 reports can be produced by a single inpulse rule. This report shows if digit collection was successful; if unsuccessful, provides reason for failure. The report is produced if a digit collection token is preceded by a REP NEXT token or a REP EACH token has been processed in the rule.
- **DTMF Digit (\$D1)**—Contains any DTMF or DP digits collected for a single digit field. Multiple \$D1 reports can be produced by a single inpulse rule. This report shows if digit collection was successful; if unsuccessful, provides reason for failure and any digits correctly received up to that point. The report is produced if a digit collection token is preceded by a REP NEXT token or a REP EACH token has been processed in the rule, or a digit timer expired and CONT REP was used in collection setup.
- **Resource Limitation (\$D6)**—Indicates an MF/DTMF receiver or IPRC port was not available when required for rule processing.
- **Incoming Port Change of State (\$DB)**—Indicates the incoming port identified in the report has gone off hook. Report produced if a REP EACH token has been processed in the rule.
- **Inpulse Rule Complete (\$DD)**—Indicates rule processing has ended for the port identified in the report. This report is a macro report that can contain MF Digit, DTMF Digit, and Incoming Port Change of State report segments. Content is based on the Reporting Control token used. If no Reporting Control token is used, this report contains all reports produced by the rule and not already reported.
- **Voice Port Status (\$DE)**—Indicates that all voice prompts specified in a Voice Port Control (\$6C) command have completed. This report is produced if a REP EACH token has been processed in the rule.

## Outpulse Rules

An outpulse rule is a listing of tokens defined by an application designer or system administrator. You can use up to 16 tokens to condition a trunk to wait for supervision events, and outpulse MF/DTMF digits. Up to 30 outpulse rules can be defined.

Outpulse rules can be executed for any line or trunk in the system, regardless of its class of service (COS). An outpulse rule can also specify to execute an inpulse rule as part of outpulse rule processing; when the inpulse rule has been completed, the original outpulse rule processing continues.

Available outpulse rule tokens and available system tones are listed in Table 2-2 and Table 2-3. The column [xx] indicates if additional data is required to complete a token. Additional tokens for optional system software (TeleRouter, ISDN, and ISDN with NFAS software packages) are detailed in the documentation that accompanies those options.

Outpulse rule tokens are functionally divided into the following groups:

- **Reporting control**—Notifies the host of supervision events detected on an outgoing or incoming port.

Reporting for individual signaling events specified by WAIT SUP is controlled by either an intermediate answer supervision template, if preceded by an ANS SUP [xx] token, or controlled by an ISDN supervision template, if preceded by an ISDN SUP [xx] token.

Reporting for individual signaling events specified by FINAL SUP is controlled by either a final answer supervision template, if preceded by an ANS SUP [xx] token, or controlled by an ISDN supervision template, if preceded by an ISDN SUP [xx] token.

- Signaling Mode—Determines the type of outpulse signaling used; DTMF, MF, or TONE mode with OP DIGIT.
- Supervision Control—Conditions the port to detect and respond to answer supervision events before continuing with rule processing. Indicates which configurable answer supervision template or preconfigured template to use for supervision.
- Digit Field—Determines when and what digits or tones are outpulsed.
- Processing Control—Allows construction of rules with more than 16 tokens for processing an inpulse rule.

*Table 2-2 Outpulse Rule Token and [xx] Choices*

Token	Type	Definition	[xx]
ANS SUP [xx]	Supervision Control	Calls the template. WAIT SUP or FINAL SUP following ANS SUP causes Intermediate FINAL.	1 to 24
DO IRULE [xx]	Processing Control	Execute inpulse rule specified in field [xx] and return to next token in this rule.	1 to 30
DO ORULE [xx]	Processing Control	Execute outpulse rule specified in field [xx] and return to next token in this rule.	1 to 30
FINAL SUP <sup>1</sup>	Supervision Control	Execute supervision template specified during wait for final supervision.	Answer supervision template: 1 to 24, or A
GOTO RULE [xx]	Processing Control	Execute outpulse rule specified in field [xx] without returning to this rule.	1 to 30
ISDN RX	Supervision Control	Specify to use an ISDN message template during rule processing.	1 to 96
ISDN SUP	Supervision Control	Specify which ISDN supervision template is used during outpulse rule processing.	1 to 24
ISDN TX	Supervision Control	Specify which ISDN message template to use to construct an outgoing D-channel message.	1 to 96
NOHOST [xx]	Processing Control	Execute a specified inpulse rule upon the expiration of the host setup timer. If no host command is received in that time, the system executes the inpulse rule indicated in the NO HOST [xx] token data field.	1 to 30
OP ANI <sup>1</sup>	Digit Field	Outpulse the digits stored in the call record ANI field.	—
OP CAT [xx]	Digit Field	For MFCR2 only. Outpulse the calling party category.	0 to 15
OP CAT2	Digit Field	For MFCR2 only. Outpulse different category digits from within a \$69 command.	—

Table 2-2 Outpulse Rule Token and [xx] Choices (continued)

Token	Type	Definition	[xx]
OP DIGIT [xx] <sup>1</sup>	Digit Field	Outpulse digit or tone specified in field [xx]. The token data field accepts fourth-column DTMF digits when “Enable 4th Column DTMF” feature flag is enabled.	DTMF mode: 0 to 9, *, #, A to F (*, E and #, F are interchangeable). MF mode: 0 to 9, KP, ST, S1, S2, S3. Tone mode: 0 to 8 <sup>2</sup> .
OP DTMF	Signaling Mode	Outpulse in DTMF mode.	—
OP FIELD [xx] <sup>1</sup>	Digit Field	Outpulse the digits stored in the call record field specified in field [xx].	1 to 4
OP MF	Signaling Mode	Outpulse in MF mode.	—
OP MFCR2	Signaling Mode	Outpulse in MFCR2 mode.	—
OP PULSE	Signaling Mode	Sets the outpulse mode to dial pulse.	—
OP TONE	Signaling Mode	Outpulse in tone mode.	—
RELEASE [xx]	Resource Control	Remove the specified resource type from the call.	IPRC, MRC, DRC, DTG, CPA, or MCR. Data must be typed (case sensitive); it is not selectable.
REP END	Reporting Control	Report the end of outpulse rule processing.	—
REP NEXT	Reporting Control	Used as outpulse rule in MFCR2 processing only. Causes final backward supervision tone to be reported to the host in Outgoing Port Change of State report (\$DA).	—
RETAIN [xx]	Reporting Control	Hold on to the specified resource type from the call.	IPRC, DTMF, MCR, and DRC. Data must be typed (case sensitive); it is not selectable.
SEIZE	Supervision Control	Perform outward seizure on outgoing trunk.	—
TIME SUP [xx] <sup>1</sup>	Supervision Control	Wait the number of seconds to receive expected supervision.	1 to 60
WAIT SUP <sup>1</sup>	Supervision Control	Treat ANS SUP [xx] as WAIT intermediate.	Answer supervision template: 1 to 24, A, or W
WAIT TIME [xx] <sup>1</sup>	Supervision Control	Wait the number of 250ms intervals specified in field [xx].	1 to 10

1. Refer to the “Recursive (Looping) Rules” section on page 2-10 for information on the use of these tokens in recursive rules.

2. Refer to Table 2-3 for decimal tone values and their corresponding tones.



*Table 2-3 OP DIGIT Values for OP TONE Mode*

Tone	Value
Quiet Tone	0
Dial Tone	1
Ring Back Tone	2
Busy Tone	3
380 Hz Tone	4
440 Hz Tone	5
480 Hz Tone	6
1400 Hz Tone	7
913.8 Hz SIT	8

## Beginning Outpulse Rule Processing

Outpulse rule processing can begin in one of the following ways:

- Ordered by host command—An outpulse rule can be started by the host using an Outgoing Port Control (\$69) or an Incoming Port Control (\$6A) command with an Outgoing Port Control segment. Refer to Chapter 4, “System Commands,” for more information.
- Started by an inpulse rule DO ORULE token—An outpulse rule can be started by a DO ORULE token in an inpulse rule.

## Ending Outpulse Rule Processing

Outpulse rule processing ends normally when all instructions in the rule (or rules if GOTO RULE or DO IRULE/ORULE tokens are used) have been executed. Processing is aborted when a supervision or resource allocation error occurs.

## Reports Produced by Outpulse Rule Processing

The following reports can be produced by outpulse rule processing:

- Outgoing Port Change of State (\$DA)—In MF and DTMF processing, this report indicates the answer supervision template that was executed, and the individual supervision events detected. The report is generated only if a WAIT SUP [xx] or FINAL SUP [xx] supervision control token is used in the rule. If REP END token is used, a \$DA report is produced to indicate outpulse rule processing has completed.

In MFCR2 processing, the \$DA report includes the backward signaling codes. When REP NEXT is used in the outpulse rule template, the final backward supervision signaling code is reported to the host in the report.

- Incoming Port Change of State (\$DB)—Indicates the answer supervision template executed, and the individual supervision events detected. The report is generated only if a WAIT SUP [xx] or FINAL SUP [xx] supervision control token is used in the rule. If a REP END token is used, a \$DB report is produced to indicate outpulse rule processing has completed.

## Recursive (Looping) Rules

You can use processing control tokens to create recursive rules, or rules for which processing eventually returns to the original rule. To create these “looping” rules use the DO IRULE, DO ORULE, and GOTO RULE tokens and continue until one of the following conditions occurs:

- An external event, such as a host command or a port on hook, is detected.
- Forty tokens are processed without any of the following tokens being encountered:
  - Inpulse rule tokens—IP ANI, IP FIELD, WAIT TIME, SPEAK.
  - Outpulse rule tokens—WAIT SUP [xx], FINAL SUP [xx], TIME SUP [xx], WAIT TIME, OP DIGIT, OP ANI, OP FIELD.

Looping allows single digit collection in inpulse rules, such as that employed when a user is prompted (by a Voice Response Unit or similar peripheral equipment) to answer questions by pressing a button on their phone. The inpulse rule below could be used for that purpose.

```
REP EACH
DTMF
DIGITS      1
IP FIELD    1
GOTO RULE   1
```

## Null Outpulse Rule

In addition to user-defined outpulse rules, a predefined Null Outpulse Rule (rule 0) exists in the VCO/4K system software. This rule is not accessible by system administration and cannot be altered. The Null Outpulse Rule is defined as shown below:

```
SEIZE
TIME SUP    30
FINAL SUP   A
```

The rule performs an outward seizure, starts a 30-second grace timer and waits for final answer. When the Null rule is specified in an Outgoing Port Control (\$69) command executed for an outgoing port, the port is considered answered if either true answer is detected or the grace timer expires.

## Answer Supervision Templates

Supervision processing is performed by a combination of supervision control outpulse rule tokens and answer supervision templates. The outpulse rule tokens WAIT SUP [xx] and FINAL SUP [xx] are used for intermediate supervision and final supervision, respectively. During outpulse rule processing, these

tokens “call” specific answer supervision templates like subroutines. The templates indicate which signaling events must be detected and the system response to each event. When an event is detected, the system response specified in the template is performed; the supervision control outpulse rule token is satisfied and rule processing continues.

Call progress tone events detected during template processing include:

- Dial
- Busy
- Fast Busy (Reorder)
- Special Information Tone (SIT)
- Audible Ringback
- Ringback Cessation
- Presence of Voice
- Voice Cessation
- Pager Cue

Answer supervision templates accessed via system administration allow users to specify system actions for particular signaling events. Signaling events include the events listed above, plus wink, true answer, supervision timing and hook flash. Condition tokens assigned to each type of signaling event determine system action when these events are detected. Preconfigured templates corresponding to the outpulse rule tokens WAIT SUP A, WAIT SUP W and FINAL SUP A exist for simple wink and answer supervision scenarios. Refer to the *Cisco VCO/4K System Administrator's Guide* for more information on answer supervision templates.

