In an open CDMA Network, the trunks connecting the Base Station Controller (BSC) and Mobile Switching Center (MSC) need to be managed and maintained by network operators to ensure that resources are used efficiently and reliably. In many cases, the MSC and BSC are physically separated and the terrestrial connections are established using leased T1 or E1 trunks. By effectively utilizing terrestrial resources, network operators can reduce operating expenses and improve system reliability. CDGIOS specifies the procedures and messaging, known as Terrestrial Circuit Management (TCM), to manage terrestrial resources effectively.

In addition to TCM, Terrestrial Facilities Management also includes the management of links, Link Sets, and Route Sets. Since these functions were already discussed in Chapter 2, “Signaling System 7 Basics,” on page 29, this chapter focuses on the messages and procedures used to manage the states of terrestrial circuit resources shared between a BSC and MSC. Usually the term terrestrial resource refers to individual 64 kbps DS0 timeslots that are dedicated for Pulse Code Modulation (PCM) voice or data services traffic. This chapter also includes descriptions of the procedures and messages used to manage soft handoff resources between two BSCs, which may consist of packetized data and virtual circuits. The overall goal of TCM is to ensure that no hung resources exist and that all available circuits are utilized.

### 8.1 Terrestrial Circuit Management Overview

The TCM functions running on both the MSC and BSC utilize three procedures to manage the states of terrestrial circuits. Together, the three procedures provide the capability to reset the states of one or more circuits or to prevent the use of individual circuits. The procedures described in this section apply only to the circuits that compose the A2-Interface; the circuits
that are part of the A7-Interface are discussed separately in Section 8.5, “A7-Interface Global Reset,” on page 528. The three TCM procedures are:

- Block and Unblock
- Reset Circuit
- Global Reset

The overall state of an individual terrestrial circuit is categorized by its usability state and traffic state. The usability state of a circuit indicates whether the circuit has been blocked by the BSC. The BSC sends a Block message to the MSC after identifying that a circuit (or group of circuits) is out of service, indicating to the MSC that it should not request the circuit (or circuits) for future call setups. The BSC may block circuits due to equipment failure or as a result of administrative procedures. The BSC unblocks a previously blocked circuit by sending an Unblock message to the MSC. In addition to the usability state, each terrestrial circuit has associated with it a traffic state. The traffic state specifies whether the circuit is Busy with a call or if it is Idle.

It is important to note that the usability state and traffic state of an individual circuit are independent of each other. For example, a circuit may be Blocked and Busy, if the Block message was sent by the BSC for a circuit already in use. A circuit is said to be available only when it is Unblocked and Idle. Both the MSC and BSC actively maintain the states of each individual terrestrial circuit.

Since usability and traffic state mismatches sometimes occur between the MSC and BSC, CDGIOS specifies two procedures for synchronizing the states. The Reset Circuit procedure is used to reset the state of an individual circuit and the Global Reset procedure is used to reset the states of all circuits shared between the MSC and BSC. Although Reset Circuit and Global Reset messages are sent by both the MSC and BSC, Block and Unblock messages are sent only by the BSC.

Each terrestrial circuit is assigned a logical identifier known as its Circuit Identity Code (CIC). Both the MSC and BSC use this logical identifier to reference a particular circuit. Section 8.1.5, “Spans and Circuits Identity Assignment,” on page 502 describes how CIC values are coded in A-Interface messages.

### 8.1.1 Block and Unblock

The usability state of a CIC can be changed by the BSC through the use of the Block or Unblock procedures. Upon determining that a CIC should no longer be used, the BSC performs a local administrative procedure to designate the CIC as blocked, then sends an A-Interface Block messages to the MSC, informing the MSC of the unavailability of the circuit. The Block message may specify an individual CIC or a group of CICs to be blocked by the MSC. After receiving the Block message, the MSC designates the CIC as blocked and prevents it from being
used in future call setups by removing it from its available CIC list. The MSC acknowledges each received Block message with a Block Acknowledge message.

The BSC typically blocks CICs when it determines that a previously configured range of CICs must be taken out of service for maintenance reasons or because of a failure. The MSC may also block CICs that it determines should no longer be used. Because the MSC has control over which CICs are allocated for calls, no messaging is required to inform the BSC of MSC-blocked CICs. In the case of MSC blocked CIC’s, the MSC simply does not allocate the locally blocked CICs when sending an Assignment Request message to the BSC.

Upon determining that a previously blocked CIC should be made available for use, the BSC sends an Unblock message to the MSC, specifying the CIC (or group of CICs) to be returned to service. The MSC acknowledges each received Unblock message with an Unblock Acknowledge message. As is discussed in Section 8.3, “Reset Circuits,” on page 510 and Section 8.4, “Global System Reset,” on page 516, the states of a CIC (or group of CICs) can also be changed to the Unblocked and Idle state through the use of the Reset Circuit or Global Reset messages.

To prevent inconsistencies in circuit states, the TCM functions at both the BSC and MSC wait for the remote end to acknowledge TCM messages before changing the state of a circuit. For example, if the BSC sends an Unblock message for a CIC and does not receive an acknowledgment from the MSC within a specified period of time, the CIC remains Blocked.

Since Block and Unblock messages are not associated with a Signaling Connection Control Part (SCCP) connection, the messages are sent as connectionless SCCP Unit Data (SCCP-UDT) class 0 messages. CDGIOs allows the BSC to send Block and Unblock messages for each CIC or to group of multiple CICs in a single message.

The Block and Unblock procedures and messages are discussed further in Section 8.2, “Blocks and Unblocks,” on page 503.

8.1.2 Reset Circuit

The MSC or BSC performs the Reset Circuit procedure when a failure affecting part of the equipment occurs or when requested by network operators through Operations and Maintenance (OA&M) actions. A Reset Circuit message is also sent by the MSC or BSC whenever either entity detects that one or more CIC’s have been idled, due to an abnormal SCCP release.

Reset Circuit is typically triggered when an SCCP connection associated with a call is lost unexpectedly. This is known as an abnormal SCCP release and occurs when one node unexpectedly sends an SCCP Released (SCCP-RLSD) message. The receiving node responds with the SCCP Release Complete (SCCP-RLC) and requests the remote end to idle the associated terrestrial circuit by sending a Reset Circuit message.

The Reset Circuit message is sent by the entity at the receiving end of an abnormal SCCP release to request the remote node to idle one or more CICs. Upon receiving a Reset Circuit, the remote end responds with a Reset Circuit Acknowledge message if it is able to idle the specified CIC (or group of CICs). If the Reset Circuit is initiated by the MSC and some of the specified
circuits are blocked at the BSC, the BSC responds with a Block message in addition to the Reset Circuit Acknowledge message.

### 8.1.3 Global Reset

The Global Reset procedure is used by the BSC and MSC to bring the remote node into a known state after a global failure occurs, during initialization, and when requested by the network operator through the use of OA&M actions. Unlike the Block and Reset Circuit messages, which are sent for an individual CIC or group of CICs, the Reset message applies to all CICs. After receiving a Reset message, the remote node releases all affected calls and all affected call references. After placing its CICs in idle mode and upon expiry of a guard timer, a Reset Acknowledge message is sent to indicate the receipt of the Reset message.

### 8.1.4 Terrestrial Circuit States Transition

Figure 8-1 illustrates the states and state transitions associated with CICs at the BSC and MSC. Both the MSC and BSC maintain the current state of all configured CICs and utilize A-Interface messages to notify the remote end of state changes. Reset Circuit and Global Reset messages are used by both the MSC and BSC to reset CICs after an abnormal event has occurred or during initialization. The BSC may also use Block and Unblock messages to inform the MSC of changes in CIC availability at the BSC. Only CICs in the Unblocked and Idle state are available for use.

**Global Reset**  The MSC or BSC may send a Reset message to the remote end to synchronize the states of the configured CICs. Upon receiving a Reset message from the BSC, the MSC releases all existing call references and idles the CICs associated with the BSC. After idling the CICs, the MSC may locally block CICs that it determines should not be used or when it is directed to block them by the BSC.

The BSC, upon receiving a Reset message from the MSC, places all CICs in the Unblocked and Idle state. The BSC may then send block messages to prevent the MSC from allocating CICs that the BSC determines are out of service. For example, prior to receiving a Reset message from the MSC, the state of a CIC at the BSC may be Blocked and Busy. After receiving a Reset message, the BSC transitions the CIC to the Unblocked and Idle state, then executes the procedure to block the CIC (if conditions still exist that require the CIC to be blocked).

**Assignment Request/Assignment Complete**  Although the BSC may request that a particular CIC be used for a call attempt, the MSC is responsible for specifying the terrestrial circuit used for a call. Upon sending an Assignment Request message to the BSC, the MSC transitions the state of the requested CIC from Unblocked and Idle to Unblocked and Busy. The BSC, after setting up the radio link and seizing the terrestrial circuit specified in the Assignment Request message, transitions the CIC state at the BSC to Unblocked and Busy, then sends an Assignment Complete.
**Clear Command** As discussed earlier, either the BSC or MSC may initiate call clearing. BSC-initiated call clearing begins with the BSC sending a Clear Request message, which prompts the MSC to respond with a Clear Command message. Upon sending the Clear Command message to the BSC, the MSC releases call resources, then returns the previously allocated CIC to the Unblocked and Idle state. After receiving the Clear Command message, the BSC releases associated call resources, including Idling the CIC. As shown in Figure 8-1, it is also possible for a circuit to be blocked during a call, resulting in a Blocked and Busy state. The Blocked and Busy CIC is placed in the Blocked and Idle state after call clearing has occurred.

![Terrestrial Circuit States and State Transitions](#)

**Figure 8-1** Terrestrial Circuit States and State Transitions

**Reset Circuit** When the BSC or MSC performs a Reset Circuit action, the CIC (or group of CICs) is transitioned from its current state to the Unblocked and Idle state. If the CIC (or group of CICs) specified in the Reset Circuit initiated by the MSC is blocked at the BSC, the BSC responds with a Block message, and the circuit is transitioned to the Blocked and Idle state.

**Block** When initiating the block procedure for a CIC, the BSC sends a Block message to the remote end and transitions the state of the circuit from Unblocked to Blocked, regardless of whether the circuit is Busy or Idle. The MSC, upon receiving the Block message, also places the CIC in the Blocked state.
**Unblock** When the BSC determines that a CIC should be unblocked, it sends the MSC an Unblock message and places the CIC in the Unblocked state. The MSC, upon receiving the Unblock message, also places the circuit in the Unblock state.

A-Interface TCM messages such as Blocks, Unblocks, Reset Circuit, and Reset, are used to inform the remote end of local state change and to execute the required actions to make the remote and local states consistent. As was mentioned earlier, if A-Interface TCM messages are not acknowledged, the local end takes appropriate actions to ensure state consistency. For example, if the MSC does not acknowledge an Unblock message sent by the BSC, the CIC remains blocked at the BSC.

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**8.1.5 Spans and Circuits Identity Assignment**

Figure 8-2 illustrates voice trunks connecting the MSC and BSC. Recall that the A-Interface contains an A1-Interface used for signaling and an A2-Interface used to carry voice traffic between the MSC and BSC. The A2-Interface is comprised of CICs configured at both the MSC and BSC. Each CIC is associated with a particular timeslot on a trunk (sometimes referred to as spans) connecting the MSC and BSC. In order for the MSC and BSC to successfully coordinate
the allocation of terrestrial resources for a call, logical CIC assignments at both the MSC and BSC must match. A mismatch in CIC assignments will result in a call without voice. For example, a CIC mismatch may cause the BSC to transmit PCM voice frames on a timeslot different than the MSC is expecting, and the MSC will be unable to connect the mobile subscriber to the intended land or mobile party.

A-Interface messages use a 16-bit field contained in the Circuit Identity Code or Circuit Identity Code Extension IE to identify CICs. The 16-bit CIC field contains an 11-bit field that identifies the PCM identity of the trunk (sometimes called the Logical Span Id) and a 5-bit field that specifies the timeslot. Figure 8-2 shows two examples of how CIC codes are computed from the logical span Id and timeslot.

To prevent invalid CIC assignments, any CICs configured at the MSC that are not configured at the BSC must be locally blocked at the MSC and removed from the MSC’s available CIC list. If the MSC requests an invalid CIC from the BSC in the Assignment Request message, due to an error condition or invalid configuration, the BSC responds with an Assignment Failure message to the MSC.

8.2 Blocks and Unblocks

This section presents the call flow and messages for both the Block and Unblock procedures. Block and Unblock messages always originate from the BSC and are used to notify the MSC of changes in CIC states detected by the BSC. The MSC may also block circuits locally, however, because the MSC can prevent CICs from being used by simply removing the CICs from its available CIC list, no A-Interface messaging is required.

8.2.1 Block Call Flow

A Block message is sent from the BSC to the MSC after the BSC determines that a circuit or a group of circuits should not be used for call processing. Upon receiving the Block message, the MSC transitions the CIC state to Blocked and removes the CIC from its active CIC list. The blocked CICs remain out of service at the MSC until a Reset, Reset Circuit, or Unblock message is received from the BSC.

![Figure 8-3 Block procedure at BSC call flow](image_url)
Figure 8-3 shows the call flow for the Block procedure. The BSC initiates the blocking of one or more CICs by sending a Block message to the MSC. The Block message also contains a cause value that specifies the reason for the block request.

Upon receipt of the Block message, the MSC marks the circuit (or circuits) as blocked and acknowledges the BSC with a Block acknowledge message.

1. Block (A-Interface):
   Upon determining that a terrestrial circuit (or group of circuits) should be blocked, the BSC marks the CIC (or group of CICs) as blocked and sends a Block message to the MSC. The BSC starts timer T1 to wait for a Block Acknowledge message from the MSC.
   In addition to specifying the one or more CICs to be blocked, the Block message also contains the reason for issuing the block request. CDGIOs allowable cause values are OA&M intervention, no radio resource available, and equipment failure.

2. Block Ack (A-Interface):
   Upon receiving a Block message from the BSC, the MSC locally blocks the specified CICs and sends a Block Acknowledge message to the BSC, indicating to the BSC that the CICs have been blocked at the MSC. If the Block message received from the BSC specifies a group of circuits to be blocked and the MSC was unable to block all of the CICs, the MSC has the flexibility of specifying which circuits were successfully blocked in the Block Acknowledge message.
   CICs blocked by the MSC in response to a Block message from the BSC remain in the blocked state until the BSC sends an Unblock message or Reset Circuit message or if the MSC initiates a Global Reset.
   If a Block message is received by the MSC for a CIC that is already allocated to a call, the call is not dropped. In this case, the MSC sends a Block Acknowledge message immediately to the BSC and waits for normal call clearing before designating the CIC as blocked.
   The BSC stops timer T1 upon receipt of the Block Acknowledge message from the MSC. If T1 expires before a Block Acknowledge message is received, the BSC resends the Block message to the MSC once more and marks the circuit (or group of circuits) as blocked, regardless of whether it receives an acknowledgment from the MSC. If the MSC does not respond with a Block Acknowledge message, it is possible that a CIC state mismatch may exist and that the MSC will include the BSC blocked CIC in an Assignment Request message. If this occurs, the BSC responds to the Assignment Request with an Assignment Failure message with cause value “terrestrial resource unavailable.” The BSC subsequently sends a Block message to the MSC with the cause value set to “no radio resource available.”
8.2.2 Unblock Call Flow

Unblock messages are sent from the BSC to the MSC once the BSC determines that a previously blocked circuit (or a group of circuits) is available for service. Upon receiving an Unblock message, the MSC returns the specified CIC(s) to service and updates its available CIC list.

Figure 8-4 shows the call flow for the Unblock procedure. After determining that a CIC should be made available for service, the BSC sends an Unblock message to the MSC and starts timer T1.

Upon receipt of the Unblock message, the MSC marks the circuit as unblocked and sends the BSC an Unblock Acknowledge message. Detail descriptions of the individual call flow stages follow Figure 8-4.

1. Unblock (A-Interface):
The BSC requests that the MSC unblocks one or more previously blocked terrestrial circuits by sending an Unblock message over the A-Interface. Upon sending the Unblock request, the BSC marks one or more CICs specified in the message as unblocked and starts timer T1 to wait for an Unblock Acknowledge.

2. Unblock Ack (A-Interface):
Upon receipt of the Unblock message, the MSC marks the previously blocked CIC(s) as Unblocked and sends an Unblock Acknowledge message to the BSC. The Unblock Acknowledge message identifies the one or more CICs unblocked at the MSC. If a group of circuits is specified by the BSC in the Unblock message, the MSC may acknowledge individual circuits or the entire group in the Unblock Acknowledge message. This provides the MSC with the flexibility to indicate which of the requested CICs were successfully unblocked. The unblocked CIC(s) may then be allocated by the MSC for traffic services in future Assignment Request messages.

The BSC stops timer T1 upon receipt of the Unblock Acknowledge message. If T1 expires before an Unblock Acknowledge message is received at the BSC, the BSC resends the
Unblock message a second and final time. If no acknowledgment is received for the second unblock attempt, the CIC remains blocked at the BSC.

8.2.3 Blocks and Unblocks Messages

The following sections contain descriptions of the A-Interface messages that are used in the Block and Unblock procedures.

8.2.3.1 Block

The Block message (Table 8-1) is sent by the BSC to request the MSC to block one or more terrestrial circuit or a group of terrestrial circuits. It is a BSMAP message that is sent as a connectionless SCCP Unit Data (SCCP-UDT) message type.

The first parameter following the message type Information Element (IE) is the mandatory Circuit Identity Code IE, which specifies the CIC to be blocked at the MSC.

The mandatory Cause IE contains the reason why the BSC is requesting the MSC to block the specified CIC. CDGLOS-allowable cause values are "operations and maintenance," "equipment failure," and "no radio resource available."

The optional Circuit Group IE provides a means of specifying a group of CICs to be blocked and avoids the need to send individual Block messages for each CIC. The BSC may use the Circuit Group IE in one of several ways.

The BSC may use the Circuit Group IE to specify an inclusive group of CICs to be blocked by setting the 1-bit “Inclusive” field to 1. In this case, the “Count” octet specifies the number of CICs to be blocked and is followed by the “First CIC” in the group. Upon receiving the Block message, the MSC blocks all CICs in the range \([1^{st} \text{ CIC}, 1^{st} \text{ CIC} + \text{count} - 1]\).

The second way that the BSC may use the Circuit Group IE is to specify a range of CICs, then selectively choose CICs within that range to be blocked. In this case, the 1-bit “Inclusive” field is set to zero and a Circuit Bitmap field that indicates which CICs in the group should be blocked is also included. For example, if the first two and the last four CICs of a 16-CIC group must be blocked, the Circuit Bitmap field is set to:

\[
\begin{array}{c}
1111 \\
0000 \\
0011 \\
\end{array}
\]

As with the inclusive method, the CIC group is specified using the Count and First CIC fields.

The final way that the BSC may use the Circuit Group IE to specify a range of CICs to be blocked is to set “All Circuits” field to 1. In this case, all CICs shared between the MSC and BSC are blocked.

It is possible to include multiple instances of the Circuit Group IE. However, the First CIC field in the first instance must match the mandatory Circuit Identity Code IE in the same message.
8.2.3.2 Block Acknowledge

The Block Acknowledge message is sent from the MSC to the BSC to acknowledge the blocking of a terrestrial circuit specified in a previously received Block message (Table 8-2). The Block Acknowledge message is a BSMAP message that is sent as a connectionless SCCP Unit Data (UDT) message type.

The first parameter following the message type IE is the mandatory Circuit Identity Code IE, which specifies the CIC to be blocked at the MSC.

The optional Circuit Group IE provides a means of specifying a group of CICs blocked by the MSC and avoids the need to send individual Block Acknowledge messages for each CIC.
For more information about how this parameter is used please refer to the description provided for the Block message in Section 8.2.3.1, “Block,” on page 506.

- **BSAP Message Type:** BSMAP
- **SCCP Message Type:** SCCP-Unit Data (UDT)
- **Direction:** BSC ← MSC

### Table 8-2  Block Acknowledge Message (CDGIOŚ 6.1.6.3)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0000 (00H)</td>
<td>BSMAP header</td>
<td>2</td>
<td>Msg Discrim. = 0 (BSMAP)</td>
<td>M</td>
<td>6.2.2.1</td>
</tr>
<tr>
<td>LLLL LLLL</td>
<td></td>
<td></td>
<td>L = BSMAP msg length</td>
<td></td>
<td>6.2.2.3</td>
</tr>
<tr>
<td>0100 0001 (41H)</td>
<td>Msg Type</td>
<td>1</td>
<td>Block Ack Msg</td>
<td>M</td>
<td>6.2.2.4</td>
</tr>
<tr>
<td>..........</td>
<td>Circuit Identity Code</td>
<td>3</td>
<td>Same as element in Table 8-1, Block message</td>
<td>M</td>
<td>6.2.2.22</td>
</tr>
<tr>
<td>0000 0001 (01H)</td>
<td>Circuit Group Variable</td>
<td></td>
<td>Same as element in Table 8-1, Block message</td>
<td>O,C</td>
<td>6.2.2.148</td>
</tr>
</tbody>
</table>

#### 8.2.3.3 Unblock

The Unblock message (Table 8-3) is sent from the BSC to the MSC to unblock one or more specified terrestrial circuits. This BSMAP message is sent as a connectionless SCCP-UDT message type.

The first parameter following the message type IE is the mandatory Circuit Identity Code IE, which specifies the CIC to be unblocked at the MSC.

The optional Circuit Group IE provides a means of specifying a group of CICs to be unblocked and avoids the need to send individual Unblock messages for each CIC. For more information about how this parameter is used please refer to the description provided for the Block message in Section 8.2.3.1, “Block,” on page 506.

- **BSAP Message Type:** BSMAP
- **SCCP Message Type:** SCCP-Unit Data (UDT)
- **Direction:** BSC → MSC
8.2.3.4 Unblock Acknowledge

The Unblock Acknowledge (Table 8-4) message is sent from the MSC to the BSC to acknowledge the unblocking of a terrestrial circuit specified in a previously specified Unblock message. This BSMAP message is sent as a connectionless SCCP-UDT message type.

The first parameter following the message type IE is the mandatory Circuit Identity Code IE, which specifies the CIC unblocked at the MSC.

The optional Circuit Group IE provides a means of specifying a group of CICs unblocked by the MSC and avoids the need to send individual Unblock Acknowledge messages for each CIC. For more information about how this parameter is used please refer to the description provided for the Block message in Section 8.2.3.1, “Block,” on page 506.

- BSAP Message Type: BSMAP
- SCCP Message Type: SCCP-Unit Data (UDT)
- Direction: BSC ← MSC

### Table 8-3 Unblock Message (CDGIOS 6.1.6.4)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
</table>
| 0000 0000 (00H)
LLL LLLL | BSMAP header | 2 | Msg Discrim. = 0 (BSMAP) L = BSMAP msg length | M | 6.2.2.1 6.2.2.3 |
| 0100 0010 (42H) | Msg Type | 1 | Unblock Msg | M | 6.2.2.4 |
| 0000 0001 (01H) ....... | Circuit Identity Code | 3 | Same as element in Table 8-1, Block message | M | 6.2.2.22 |
| 0001 1001 (19H) ....... | Circuit Group Variable | Same as element in Table 8-1, Block message | O,C | 6.2.2.148 |

### Table 8-4 Unblock Acknowledge Message (CDGIOS 6.1.6.5)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
</table>
| 0000 0000 (00H)
LLL LLLL | BSMAP header | 2 | Msg Discrim. = 0 (BSMAP) L = BSMAP msg length | M | 6.2.2.1 6.2.2.3 |
| 0100 0011 (43H) | Msg Type | 1 | Unblock Ack Msg | M | 6.2.2.4 |
8.3 Reset Circuits

The Reset Circuit procedure may be initiated by either the BSC or the MSC and is invoked when a failure affecting part of the equipment occurs or when requested by network operators through OA&M actions. The MSC or BSC sends a Reset Circuit message after either entity detects that a CIC has been idled, due to an abnormal SCCP release.

8.3.1 Reset Circuit at BSC Call Flow

Figure 8-5 illustrates the Reset Circuit message flow when the Reset Circuit action is initiated by the BSC. Upon determining that the state of one or more circuits needs to be reset, the BSC sends a Reset Circuit message to the MSC and starts timer T12. Upon receipt of the Reset Circuit message, the MSC idles the CIC(s) specified in the received message and sends the BSC a Reset Circuit Acknowledge.

**Table 8-4** Unblock Acknowledge Message (CDGIOs 6.1.6.5) (Continued)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0001</td>
<td>Circuit Identity Code</td>
<td>3</td>
<td>Same as element in Table 8-1,</td>
<td>M</td>
<td>6.2.2.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Block message</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0001 1001</td>
<td>Circuit Group Variable</td>
<td></td>
<td>Same as element in Table 8-1,</td>
<td>O,C</td>
<td>6.2.2.148</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Block message</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 8-5 Reset Circuit at BSC call flow

1. **Reset Circuit (A-Interface):**

The BSC initiates a Reset Circuit action after determining that one or more circuits have been idled as a result of an abnormal SCCP release. The BSC sends a Reset Circuit message to the MSC, requesting that the circuit(s) be idled. The message includes a cause value that indicates the reason for the reset. After sending the Reset Circuit message, the BSC starts timer T12.
The MSC, upon receipt of the Reset Circuit message, clears any affected calls and idles the CIC(s).

2. Reset Circuit Ack (A-Interface):

The Reset Circuit Acknowledge message is sent from the MSC to the BSC after idling the CICs specified in the previously received Reset Circuit message. Any specified CICs that were in the blocked state prior to receiving the Reset Circuit message are transitioned to the unblocked state.

If an existing call is using a CIC specified in the Reset Circuit message received from the BSC, the call is cleared, and the CIC is returned to the Unblocked and Idle state.

The BSC stops timer T12 upon receipt of the Reset Circuit Acknowledge message from the MSC. If T12 expires before the Reset Circuit Acknowledge message is received, the BSC resends the Reset Circuit message. CDGIOS specifies that the Reset Circuit message be sent no more than three times.

8.3.2 Reset Circuit at MSC Call Flow

The MSC-initiated Reset Circuit message flow, which is very similar to the BSC-initiated scenario, is shown in Figure 8-6.

8.3.3 Reset Circuit at MSC with Block Response Call Flow

The MSC may initiate a Reset Circuit for one or more CICs that are in the blocked state at the BSC. In such a scenario, the BSC responds to the Reset Circuit message received from the MSC with a Block message instead of a Reset Circuit Acknowledge. Any unblocked CICs are idled by the BSC, which then also sends a Reset Circuit Acknowledge message to the MSC. Figure 8-7 illustrates the call flow for a MSC-initiated Reset Circuit procedure when one or more of the specified CICs are blocked at the BSC.

1. Reset Circuit (A-Interface):

The MSC initiates the Reset Circuit procedure and sends a Reset Circuit message to the BSC to idle a group of circuits. The MSC starts timer T12.
2. Block (A-Interface):
The BSC determines that one or more CICs specified by the MSC in the Reset Circuit message are in the blocked state. The BSC then responds to the MSC with a Block message for the blocked CICs, indicating the reason for the blocking. The BSC starts Timer T1. The MSC stops timer T12 upon receipt of the Block message.

3. Reset Circuit Ack (A-Interface):
The BSC idles the remaining CICs specified in the Reset Circuit message, then informs the MSC of the action by sending a Reset Circuit Acknowledge message.

4. Block Ack (CICs) (A-Interface):
Upon receipt of the Block message, the MSC blocks the specified CICs and sends one or more Block Acknowledge messages to the BSC. The BSC stops timer T1 upon receipt of the Block Acknowledge message.

![Figure 8-7](reset_circuit_flow.png)

**Figure 8-7**  Reset Circuit at MSC with Block Response call flow

### 8.3.4 Reset Circuit Messages
The following sections provide detail descriptions of the A-Interface messages used in the Reset Circuit procedure.

#### 8.3.4.1 Reset Circuit
The Reset Circuit message (Table 8-5) is a BSMAP message sent by either the BSC or MSC to idle one or more terrestrial circuits. The message is sent as a connectionless SCCP-UDT message type.

The mandatory Circuit Identity Code IE specifies the CIC to be reset (idled) by the remote node.
CDGIOS specifies that the mandatory Cause IE may be set to either "operations and maintenance" or "equipment failure," depending on the reason for initiating the Reset Circuit.

The optional Circuit Group IE provides a means of specifying a group of CICs to be reset and avoids the need to send individual Reset Circuit messages for each CIC. For more information about how this parameter is used, please refer to the description provided for the Block message in Section 8.2.3.1, “Block,” on page 506.

- **BSAP Message Type:** BSMAP
- **SCCP Message Type:** SCCP-Unit Data (UDT)
- **Direction:** BSC ↔ MSC

### Table 8-5  Reset Circuit Message (CDGIOS 6.1.6.8)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0000 (00H) LLLL LLLL</td>
<td>BSMAP header</td>
<td>2</td>
<td>Msg Discrim. = 0 (BSMAP) L = BSMAP msg length</td>
<td>M</td>
<td>6.2.2.1</td>
</tr>
<tr>
<td>0011 0100 (34H)</td>
<td>Msg Type</td>
<td>1</td>
<td>Reset Circuit Msg</td>
<td>M</td>
<td>6.2.2.4</td>
</tr>
<tr>
<td>0000 0001 (01H) mmmm mmmm mmm ttt</td>
<td>Circuit Identity Code</td>
<td>3</td>
<td>m = spanid t = timeslot</td>
<td>M</td>
<td>6.2.2.22</td>
</tr>
<tr>
<td>0000 0100 (04H) LLLL LLLL 0ccc cccc</td>
<td>Cause</td>
<td>3</td>
<td>L = 01H, c = cause 07H—OA&amp;M intervention 20H—equipment failure</td>
<td>M</td>
<td>6.2.2.19</td>
</tr>
<tr>
<td>0001 1001 (19H) ......</td>
<td>Circuit Group Variable</td>
<td>Same as element in Table 8-1, Block message</td>
<td>O,C</td>
<td>6.2.2.148</td>
<td></td>
</tr>
</tbody>
</table>

### 8.3.4.2  Reset Circuit Acknowledge

The Reset Circuit Acknowledge message (Table 8-6) is sent by either the BSC or MSC to acknowledge the idling of the terrestrial circuit associated with a previously received Reset message. This BSMAP message is sent as a connectionless SCCP-UDT type message.

The mandatory Circuit Identity Code IE specifies the CIC successfully reset (idled).

The optional Circuit Group IE provides a means of specifying a group of CICs that have been successfully reset (idled) and avoids the need to send individual Reset Circuit Acknowledge messages for each CIC. For more information about how this parameter is used, please refer to the description provided for the Block message in Section 8.2.3.1, “Block,” on page 506.
• BSAP Message Type: BSMAP  
• SCCP Message Type: SCCP-Unit Data (UDT)  
• Direction: BSC ↔ MSC

Table 8-6  Reset Circuit Acknowledge Message (CDGIOS 6.1.6.9)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0000 (00H) LLLL</td>
<td>BSMAP header</td>
<td>2</td>
<td>Msg Discrim. = 0 (BSMAP) L = BSMAP msg length</td>
<td>M</td>
<td>6.2.2.1</td>
</tr>
<tr>
<td>0011 0101 (35H)</td>
<td>Msg Type</td>
<td>1</td>
<td>Reset Circuit Ack Msg</td>
<td>M</td>
<td>6.2.2.4</td>
</tr>
<tr>
<td>0000 0001 (01H) .....</td>
<td>Circuit Identity Code</td>
<td>3</td>
<td>Same as element in Table 8-1, Block message</td>
<td>M</td>
<td>6.2.2.22</td>
</tr>
<tr>
<td>0001 1001 (19H) .....</td>
<td>Circuit Group Variable</td>
<td>Same as element in Table 8-1, Block message</td>
<td>O,C</td>
<td>6.2.2.148</td>
<td></td>
</tr>
</tbody>
</table>

8.3.5 Reset Circuit Example Call Flow

The example message summary shown in Figure 8-8 is similar to what would be seen on test equipment monitoring the A-Interface during an abnormal SCCP release. The purpose of the example is to illustrate the Reset Circuit procedure that is invoked after the abnormal release. The summary call flow is followed by the decoded example messages. The BSC’s point code is 8-17-92, and the MSC’s point code is 110-44-3.

![Figure 8-8  Reset Circuit after Abnormal SCCP Release example call flow](image-url)
In the example shown in Figure 8-8, an established call is released abnormally by the BSC, and the MSC responds to the SCCP Released (SCCP-RLSD) message with SCCP Release Complete (SCCP-RLC). At this point the call was released at the SCCP layer but the associated CIC resource may not have been properly released. To ensure that the CIC has been idled at the BSC, the MSC sends a Reset Circuit message. Upon receiving the Reset Circuit message, the BSC idles the specified CIC and responds with a Reset Circuit Acknowledge.

<table>
<thead>
<tr>
<th>Message Number: 00029</th>
<th><strong>Start of MTP Level 3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>0003 10000011 83</td>
<td>Service Indicator SCCP</td>
</tr>
<tr>
<td>0004 (3 Bytes)</td>
<td>Destination Point Code</td>
</tr>
<tr>
<td>0007 (3 Bytes)</td>
<td>Origination Point Code</td>
</tr>
<tr>
<td>0010 00000010 02</td>
<td>Signaling Link Selection</td>
</tr>
<tr>
<td><strong>Start of SCCP</strong></td>
<td></td>
</tr>
<tr>
<td>0011 0001001 09</td>
<td>Message Type UDT</td>
</tr>
<tr>
<td>0012 00000000 00</td>
<td>Protocol Class Class 0</td>
</tr>
<tr>
<td>0013 00000011 03</td>
<td>Called Party Address Offset 0016</td>
</tr>
<tr>
<td>0014 0000101 05</td>
<td>Calling Party Address Offset 0019</td>
</tr>
<tr>
<td>0015 00000010 0a</td>
<td>Data Portion Pointer Offset 0025</td>
</tr>
<tr>
<td>0016 00000010 02</td>
<td>Called Party Addr Length 2</td>
</tr>
<tr>
<td>0017 11000001 c1</td>
<td>Subsys Number Indicator Included</td>
</tr>
<tr>
<td>0018 11111100 fc</td>
<td>Subsystem Number 252</td>
</tr>
<tr>
<td>0019 00000010 05</td>
<td>Calling Party Addr Length 5</td>
</tr>
<tr>
<td>0020 11000011 c3</td>
<td>Subsys Number Indicator Included</td>
</tr>
<tr>
<td>0021 11111100 fc</td>
<td>Subsystem Number 252</td>
</tr>
<tr>
<td>0022 (3 Bytes)</td>
<td>Signaling Point Code 110-44-3</td>
</tr>
<tr>
<td><strong>Start of CDGOS MAP</strong></td>
<td></td>
</tr>
<tr>
<td>0025 0001001 09</td>
<td>Data Length 9</td>
</tr>
<tr>
<td>0026 00000000 00</td>
<td>BSMAI Discriminator</td>
</tr>
<tr>
<td>0027 00000111 07</td>
<td>BSMAI Length 7</td>
</tr>
<tr>
<td>0028 0010100 34</td>
<td>Reset Circuit 52</td>
</tr>
<tr>
<td>0029 00000001 01</td>
<td>Circuit Identity Code Id 1</td>
</tr>
<tr>
<td>0030 00000000 00</td>
<td>PCM MUX (high part)</td>
</tr>
<tr>
<td>0031 00000010 37</td>
<td>Time Slot 7</td>
</tr>
</tbody>
</table>

The MSC initiated a Reset Circuit

Circuit to be reset
Figure 8-9  Reset Circuit message example

Figure 8-9 shows the message structure and content of a Reset Circuit message. In this example message, only one circuit is specified and is contained in the mandatory Circuit Identity Code IE. The Reset Circuit cause reason is set to OA&M intervention.

**** MESSAGE NUMBER: 00030 ****
*** Start of CDG IOS MAP ***
  Reset Circuit Acknowledge
  0028 00000110 06 Data Length 6
  0029 00000000 00 BSMAP Discriminator 00
  0030 00000100 04 BSMAP Length 4
  0031 00110101 35 Reset Circuit Acknowledge 53
  0032 00000001 01 Circuit Identity Code Id 1
  0033 00000000 00 PCM MUX (high part) 0
  0034 00000010 37 ---00111  Time Slot 7
  011-----  PCM MUX (low part) 3

Figure 8-10  Reset Circuit Acknowledge message example

Figure 8-10 illustrates the message structure and content of the Reset Circuit Acknowledge message sent from the BSC to the MSC. The BSC informs the MSC that the specified circuit (PCM Mux 3 and timeslot 7) has been successfully idled.

8.4  Global System Reset

Either the BSC or MSC initiates the Global Reset procedure when a global failure occurs or as a result of initialization. The Global Reset procedure is always invoked when the first signaling link connecting a BSC and MSC is brought into service. Upon receiving a Global Reset message, the receiving node releases the affected calls and idles all associated circuits. In the case of the BSC, Block messages may also be sent for any unavailable CICs.

8.4.1  Global Reset at BSC Call Flow

Figure 8-11 shows the Global Reset procedure call flow when initiated by the BSC. The BSC starts the procedure by sending the Reset message to the MSC and starts timer T4. Upon receipt of the Reset message, the MSC starts timer T2, releases any affected calls, and marks all associated CICs as idle and unblocked. The MSC waits for guard timer T2 to expire before sending a Reset Acknowledge message to the BSC. In the meantime, the BSC may send Blocks
to the MSC for CICs that it determines should be blocked. The call flow shown in Figure 8-11 is followed by descriptions of each individual step.

**Figure 8-11**  Global Reset at BSC call flow

1. **Reset (A-Interface):**
   Upon initialization or due to a global failure, the BSC initiates the Global Reset procedure by releasing affected calls, idling its CICs, and sending a Reset message to the MSC. The BSC then starts timer T4 to wait for a Reset Acknowledge message from the MSC.
   If the MSC receives a Reset message that indicates that the CDGIO5S software version being used by the BSC is less than that being used at the MSC, the MSC may choose to ignore the Global Reset and take appropriate OA&M actions.

2. **Blocks (A-Interface):**
   While waiting for a Reset Acknowledge message, the BSC may send Block messages for any unavailable CICs.

3. **Block Acks (A-Interface):**
   Upon receiving a Block message from the BSC, the MSC locally blocks the specified CICs and sends one or more Block Acknowledge messages to the BSC.

4. **Reset Ack (A-Interface):**
   The MSC idles all associated CICs and releases affected calls upon receipt of the Global Reset indication from the BSC. After a guard timer delay of T2 seconds, the MSC sends a Reset Acknowledge message to the BSC, indicating that it has performed the necessary reset actions.
The BSC stops timer T4 upon receiving the Reset Acknowledge message from the MSC. If T4 expires before a Reset Acknowledge message is received, the BSC repeats the Global Reset procedure.

### 8.4.2 Global Reset at MSC Call Flow

As mentioned earlier, the MSC may also initiate a Global Reset. The message flow, illustrated in Figure 8-12, is similar to the BSC-initiated Global Reset scenario described in Section 8.4.1, “Global Reset at BSC Call Flow,” on page 516. In the case of a MSC-initiated Global Reset, the MSC starts timer T16 upon sending the Reset message, and the BSC acknowledges the MSC with the Reset Acknowledge message after timer T13 expires.

**Figure 8-12** Global Reset at MSC call flow

---

### 8.4.3 Reset Glare Noted at BSC Call Flow

A Global Reset Glare may occur when both the BSC and MSC initiate the Global Reset procedure around the same time. A glare condition at the BSC occurs when the BSC-sent Reset message is lost or cannot be processed by the MSC. The call flow for Global Reset Glare at the BSC is shown in Figure 8-13. In the call flow shown, the BSC starts the Global Reset procedure and sends a Reset message to the MSC. Around the same time, the MSC also invokes the Global Reset procedure, sending a Reset message to the BSC. Upon receiving the Reset message from the MSC, the BSC determines that a Global Reset glare condition has occurred, assumes that its previously sent Reset message was lost, then processes the received Reset message. The BSC no longer proceeds with its own initiated Global Reset.
1. Reset (A-Interface):
   A Reset is first sent by the BSC, and the BSC starts timer T4. The glare condition at the BSC occurs when this message is lost or cannot be processed by the MSC, and the MSC sends its own Reset message to the BSC.

2. Reset (A-Interface):
   The MSC starts the Global Reset procedure and sends out a Reset message to the BSC and starts timer T16.
   Upon receiving the Reset message, the BSC determines that a glare condition has occurred and continues to process the received Reset message. The BSC no longer proceeds with its own initiated Global Reset procedure and assumes that the Reset message it sent was lost. The BSC stops Timer T4 and starts delay timer T13.

   If required, Blocks messages are sent from the BSC for CICs not available at the BSC.

4. Block Acks (A-Interface):
   The MSC locally blocks the specified CICs and sends one or more Block Acknowledge messages to the BSC.
5. Reset Ack (A-Interface):

Upon expiry of timer T13, the BSC sends a Reset Acknowledge. The MSC stops timer T16 after receiving this message.

### 8.4.4 Reset Glare Noted at MSC Call Flow

Parallel Global Reset procedures at both the MSC and BSC may also result in a reset glare condition at the MSC. The message flow for such a condition is similar to the BSC glare scenario described in Section 8.4.3, “Reset Glare Noted at BSC Call Flow,” on page 518. The main difference is that the MSC is the first node to send the Reset message. Upon receiving the Reset message from the BSC, the MSC determines that glare has occurred and proceeds to process the received Reset message. The MSC stops its own initiated Global Reset procedure. Figure 8-14 illustrates the message flow for Global Reset glare noted at the MSC.

#### Figure 8-14  Global Reset Glare noted at MSC call flow

### 8.4.5 Reset Glare Noted at Both BSC and MSC

When both the MSC and BSC initiate Global Reset procedures at nearly the same time, it is possible for Reset Glare conditions to occur simultaneously at both nodes. Each node determines that Reset glare has occurred when a Reset message is received soon after the initial Reset message has been sent. When this occurs, both the MSC and BSC each assume that the Reset messages they previously sent were lost, act as though they are not performing a reset procedure, and process the received Reset message. The call flow for Reset glare noted at both the MSC and BSC is shown in Figure 8-15.
1. Reset (A-Interface):

Both the MSC and BSC send Reset messages at nearly the same time. The BSC starts timer T4 and the MSC starts timer T16.

Upon receiving the Reset message from the MSC, the BSC notes that Reset glare has occurred, assumes that its previously sent Reset message has been lost, and continues to process the received Reset. The BSC stops timer T4 and starts delay timer T13.

Similarly, when the MSC receives the Reset message from the BSC, it notes that a Reset glare has occurred and assumes that the Reset previously sent was lost. MSC continues to process the received Reset.

2. Blocks (A-Interface):

If required, Blocks messages are sent from the BSC for CICs not available at the BSC.

3. Block Acks (A-Interface):

The MSC locally blocks the specified CICs and sends one or more Block Acknowledge messages to the BSC.


The MSC sends a Reset Acknowledge message after delay timer T2 expires.

Figure 8-15  Global Reset Glare noted at both BSC and MSC call flow
5. Global Reset Ack (A-Interface):
The BSC sends a Reset Acknowledge message after delay timer T13 expires.

8.4.6 Global Reset Messages
The following sections contain descriptions of the A-Interface messages used by both the MSC and BSC during a Global Reset.

8.4.6.1 Reset
The Reset message (Table 8-7) is a BSMAP message sent by either the BSC or MSC to initiate a Global Reset at the remote end. It is sent as a connectionless SCCP-UDT message type.

CDGIS specifies that the mandatory Cause IE contained in the Reset message be set to "operations and maintenance" or "equipment failure." For an operator-induced Global Reset, the Reset message is sent with a Cause IE of “operations and maintenance.”

The required Software Version IE is sent to the remote end to convey information regarding the CDGIS software version being used. The CDGIS version is specified using the $a.b.c$ format, where $a$ is the major revision, $b$ is the minor revision, and $c$ is the point release. The Software Version IE also contains a load identity for each manufacturer software load and may be used by the wireless carrier to exchange information between network entities.

- BSAP Message Type: BSMAP
- SCCP Message Type: SCCP-Unit Data (UDT)
- Direction: BSC ↔ MSC

**Table 8-7**  Reset Message (CDGIS 6.1.6.6)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0000 (00H) LLLL LLLL</td>
<td>BSMAP header 2</td>
<td>Msg Discrim. = 0 (BSMAP)</td>
<td>M</td>
<td>6.2.2.1</td>
<td></td>
</tr>
<tr>
<td>0011 0000 (30H)</td>
<td>Msg Type 1</td>
<td>Global Reset Msg</td>
<td>M</td>
<td>6.2.2.4</td>
<td></td>
</tr>
</tbody>
</table>
8.4.6.2 Reset Acknowledge

The Reset Acknowledge message is a BSMAP message sent by either the BSC or MSC to acknowledge a Global Reset (Table 8-8). It is sent after the local node has cleared all affected calls and associated SCCP connections. The Reset Acknowledge message is sent as a connectionless SCCP-UDT message type.

The required Software Version IE is sent by the BSC or MSC to the remote entity to convey CDGIOS software release information. For further details on the Software Version IE please see the description provided for the Reset message in Section 8.4.6.1, “Reset,” on page 522.

- BSAP Message Type: BSMAP
- SCCP Message Type: SCCP-Unit Data (UDT)
- Direction: BSC ↔ MSC

Table 8-7  Reset Message (CDGIOS 6.1.6.6) (Continued)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0100 (04H)</td>
<td>Cause</td>
<td>3</td>
<td>L = 01H, c = cause</td>
<td>M</td>
<td>6.2.2.19</td>
</tr>
<tr>
<td>LLLL LLLL 0ccc cccc</td>
<td></td>
<td></td>
<td>07H—OA&amp;M intervention</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20H—equipment failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0011 0001 (31H)</td>
<td>Software Ver-</td>
<td></td>
<td>L = length</td>
<td>O,R</td>
<td>6.2.2.65</td>
</tr>
<tr>
<td>LLLL LLLL aaaa aaaa</td>
<td>1</td>
<td></td>
<td>a = Major Revision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bbbb bbbb cccc cccc</td>
<td></td>
<td></td>
<td>b = Minor Revision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mmmm mmmm ……</td>
<td></td>
<td></td>
<td>c = Point Release</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>m = manufacturer information</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.4.6.2 Reset Acknowledge

The Reset Acknowledge message is a BSMAP message sent by either the BSC or MSC to acknowledge a Global Reset (Table 8-8). It is sent after the local node has cleared all affected calls and associated SCCP connections. The Reset Acknowledge message is sent as a connectionless SCCP-UDT message type.

The required Software Version IE is sent by the BSC or MSC to the remote entity to convey CDGIOS software release information. For further details on the Software Version IE please see the description provided for the Reset message in Section 8.4.6.1, “Reset,” on page 522.

- BSAP Message Type: BSMAP
- SCCP Message Type: SCCP-Unit Data (UDT)
- Direction: BSC ↔ MSC

Table 8-8  Reset Acknowledge Message (CDGIOS 6.1.6.7)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0000 (00H)</td>
<td>BSMAP Header</td>
<td>2</td>
<td>Msg Discrim. = 0 (BSMAP)</td>
<td>M</td>
<td>6.2.2.1</td>
</tr>
<tr>
<td>LLLL LLLL</td>
<td></td>
<td></td>
<td>L = BSMAP msg length</td>
<td></td>
<td>6.2.2.3</td>
</tr>
<tr>
<td>0011 0001 (31H)</td>
<td>Msg Type</td>
<td>1</td>
<td>Global Reset Ack Msg</td>
<td>M</td>
<td>6.2.2.4</td>
</tr>
<tr>
<td>0011 0001 (31H)</td>
<td>Software Ver-</td>
<td></td>
<td>Same as element in Tabl e8-7,</td>
<td>O,R</td>
<td>6.2.2.65</td>
</tr>
<tr>
<td>LLLL LLLL aaaa aaaa</td>
<td>1</td>
<td></td>
<td>Reset Message</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bbbb bbbb cccc cccc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mmmm mmmm ……</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8.4.7 Global Reset with Blocks Example Call Flow

Figure 8-16 contains a summary message call flow that is similar to what would be seen on test equipment monitoring the A-Interface when the first signaling link connecting a BSC and MSC is brought into service. The intent of this example is to illustrate the call flow associated with the Global Reset procedure, including the sending of Block messages by the BSC during system initialization. Subsequent figures illustrate the complete message’s content, including MTP and SCCP layers. In this example, the BSC’s point code is 1-1-1, and the MSC’s point code is 1-2-4.
The initial messages in Figure 8-16 are associated with the alignment of the only Signaling System 7 (SS7) signaling link connecting the MSC and BSC. MTP 2 alignment first takes place, followed by a traffic restart at MTP 3, then the exchange of signaling link test and maintenance messages. Next, the SCCP layers are brought into service at both nodes through the exchange of Subsystem Test (SST) and Subsystem Allowed (SSA) messages. Finally, the BSAP (application) layer terrestrial circuit resource function initiates a Global Reset to bring the associated CICs into service. In this example, the MSC initiates the Global Reset, and the BSC responds with multiple Block messages to inform the MSC of unavailable CICs. After completing its initialization and waiting for timer T13 to expire, the BSC responds to the previously received Reset message with a Reset Acknowledge message. At this point, both the link and terrestrial circuits are now available and in service.
(Continued)

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol Class</td>
<td>Class 0</td>
</tr>
<tr>
<td>Message Handling</td>
<td>Discard message on error</td>
</tr>
<tr>
<td>Pointer to parameter 1</td>
<td>3</td>
</tr>
<tr>
<td>Pointer to parameter 8</td>
<td>8</td>
</tr>
<tr>
<td>Pointer to parameter 13</td>
<td>13</td>
</tr>
<tr>
<td>Called address parameter</td>
<td></td>
</tr>
</tbody>
</table>

| Parameter Length       | 5         |
| Subsystem No. Indicator| SSN present |
| Point Code Indicator   | PC present |
| Global Title Indicator | No global title included |
| Routing Indicator      | Route on DPC + SSN |
| For national use       | National address |
| Subsystem number       | 252       |
| Called Party SPC       | 1-1-1     |

| Parameter Length       | 5         |
| Subsystem No. Indicator| SSN present |
| Point Code Indicator   | PC present |
| Global Title Indicator | No global title included |
| Routing Indicator      | Route on DPC + SSN |
| For national use       | National address |
| Subsystem number       | 252       |
| Called Party SPC       | 1-2-4     |

**Figure 8-17**  Global Reset message example

Figure 8-17 illustrates the message structure and content of a Reset message. The mandatory cause value is set to equipment failure because, in this example, the system was restarted, due to a system failure.
Global System Reset

(Continued)

01000000  Message Type  64
00000001  IE Name  Circuit Identity Code
00000000  PCM Multiplex a-h  0
---00001  Timeslot in use  1
001-----  PCM Multiplex i-k  1
00000100  IE Name  Cause
00000001  IE Length  1
-0000111  Cause Value  OA&M intervention
0--------  Extension bit  No extension

Figure 8-18  Block message example

Figure 8-18 illustrates the message structure and content of a Block message. Because the SCCP and MTP layers are similar to those found in the Reset message example shown in Figure 8-17, they are not repeated here. In this example, the BSC sends individual Block messages for each CIC that it determines should be blocked. The Block message shown in Figure 8-18 requests that the MSC block the CIC associated with PCM mux 1 and timeslot 1. The reason specified for requesting the block is OA&M intervention.

CDGIOS MSC - BSC (BSSMAP) (BSMAP)  BLA (= Block Acknowledge)
--------0  Discrimination bit D  BSSMAP
00000000  Filler  0
00000100  Message Length  4
01000001  Message Type  65
00000001  IE Name  Circuit Identity Code
00000000  PCM Multiplex a-h  0
---00001  Timeslot in use  1
001-----  PCM Multiplex i-k  1

Figure 8-19  Block Acknowledge message example

Figure 8-19 illustrates the message structure and content of a Block Acknowledge message. In this example message, the MSC acknowledges the blocking of a single CIC associated with PCM mux 1 and timeslot 1.

CDGIOS MSC - BSC (BSSMAP) (BSMAP)  RSTA (= Reset Acknowledge)
--------0  Discrimination bit D  BSSMAP
00000000  Filler  0
00000110  Message Length  6
00110001  Message Type  49
00110001  IE Name  Software Version
00000011  IE Length  3
00000011  IOS version  3.1.1
00000001
00000001

Figure 8-20  Global Reset Acknowledge message example
Figure 8-20 illustrates the message structure and content of a Reset Acknowledge message sent by the BSC in response to the MSC-initiated Global Reset earlier. The software version IE specifies that CDGIOS 3.1.1 is being used.

8.5 A7-Interface Global Reset

In a CDMA network, direct connections between BSCs may exist to facilitate soft handoffs between BSCs. Like the MSC–BSC interface, these BSC–BSC interfaces also require Terrestrial Facility Management procedures to maintain the integrity of the connections. Recall that the signaling portion of the BSC–BSC connection is referred to as the A7-Interface and that data is sent over the A3 traffic connection (See Section 1.3, “Open A-Interface Network Architecture,” on page 6 and Section 7.4, “IS-95 to IS-95 Direct BSC-BSC Soft Handoff,” on page 473). When a BSC experiences a failure that results in losing the A3/A7 connections, an A7 Global Reset procedure is performed to release all associated references and to reinitialize the connections.

8.5.1 A7 Global Reset at BSC Call Flow

During initialization or due to a failure that results in the BSC losing A7 transaction reference information, the BSC sends a A7-Reset message to one or more remote BSCs. The call flow for resetting the A7 connections is similar to that of a BSC-initiated Global Reset on the A1-Interface, described in Section 8.4.1, “Global Reset at BSC Call Flow,” on page 516.

Figure 8-21 shows the call flow when the A7 Reset procedure is initiated by a BSC.

After releasing all affected resources, the BSC sends A7-Reset messages to other known BSCs and starts timer T4. Upon receipt of the A7-Reset message, the remote BSCs release all affected virtual calls and references, then wait for T2 seconds before sending an A7-Reset Acknowledge message to the initiating BSC. If timer T4 expires before an A7-Reset Acknowledge message is received, the initiating BSC repeats the reset procedure with the other BSC. Figure 8-21 shows the call flow when the A7 Reset procedure is initiated by a BSC.
8.5.2 A7 Global Reset Glare Noted at Initiating BSC

As with the A1-Interface, Reset Glares may also occur over the A7-Interface. If the initiating BSC receives a A7-Reset message after sending its own A7-Reset, it determines that A7-Reset glare has occurred and assumes that its previously sent A7-Reset message was lost. The initiating (original) BSC processes the received A7-Reset and sends a A7-Reset Acknowledge message after timer T2 expires. The call flow is illustrated in Figure 8-22.

![Figure 8-22 A7 Global Reset Glare noted at initiating BSC](image)

8.5.3 A7 Global Reset Glare Noted at Two BSCs

It is possible that both the local and remote BSC encounter A7-Reset glare. Each node determines that Reset Glare has occurred when an A7-Reset message is received after the initial A7-Reset message has been sent. When this occurs, both the BSCs assume that the A7-Reset messages they previously sent were lost, stop timer T4, act as though they are not performing a reset procedure, and process the received A7-Reset message. Upon expiry of timer T2, each node sends a A7-Reset Acknowledge message to the remote end (Figure 8-23).

![Figure 8-23 A7 Global Reset noted at two BSCs](image)
8.5.4 A7 Global Reset Messages

The following sections describe the A7-Interface messages that are used in the A7 Global Reset procedure.

8.5.4.1 A7-Reset

The A7-Reset message is sent from one BSC to another BSC to initiate an A7 Global Reset (Table 8-9). All virtual connections, references, and associated transaction resources are released and reinitialized.

The required Cause IE and Software Version IE are identical to those described for the Reset message in Section 8.4.6.1, “Reset,” on page 522.

- Direction: BSC ↔ BSC

Table 8-9 A7-Reset (CDGIOS 6.1.12.11)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 1010 (8AH)</td>
<td>Msg Type II</td>
<td>1</td>
<td>A7-Reset Msg</td>
<td>M</td>
<td>6.2.2.5</td>
</tr>
<tr>
<td>0000 0100 (04H) LLLL LLLL 00cc cccc</td>
<td>Cause</td>
<td>3</td>
<td>L = 01H c = cause 07H—OA&amp;M intervention 20H—equipment failure</td>
<td>O,R</td>
<td>6.2.2.19</td>
</tr>
<tr>
<td>0011 0001 (31H) .......</td>
<td>Software Ver- sion Variable</td>
<td>Same element in Table 8-7, Reset Message</td>
<td>O,R</td>
<td>6.2.2.65</td>
<td></td>
</tr>
</tbody>
</table>

8.5.4.2 A7-Reset Ack

The A7-Reset Acknowledge message is sent from one BSC to another BSC to acknowledge the completion of an A7 Global Reset (Table 8-10).

The required Software Version IE is identical to that described for the Reset message in Section 8.4.6.1, “Reset,” on page 522.

- Direction: BSC ↔ BSC
Table 8-10  A7-Reset Ack (CDGIOS 6.1.12.12)

<table>
<thead>
<tr>
<th>BitMap</th>
<th>Param IE</th>
<th>#Oct</th>
<th>Range</th>
<th>Type</th>
<th>IOS Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 1011 (8BH)</td>
<td>Msg Type II</td>
<td>1</td>
<td>A7-Reset Ack Msg</td>
<td>M</td>
<td>6.2.2.5</td>
</tr>
<tr>
<td>0011 0001 (31H)</td>
<td>Software Version</td>
<td>Variable</td>
<td>Same element in Table 8-7, Reset Message</td>
<td>O.R</td>
<td>6.2.2.65</td>
</tr>
</tbody>
</table>

References
