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Application Messaging with SAS[®] 9.2



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Application Messaging with SAS® 9.2

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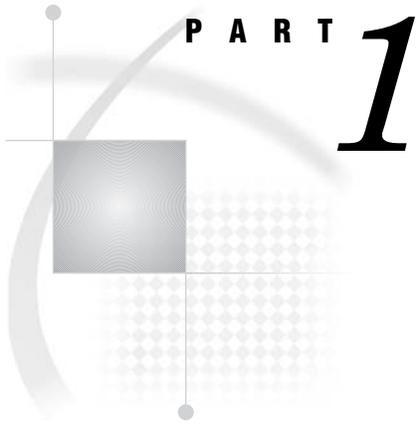
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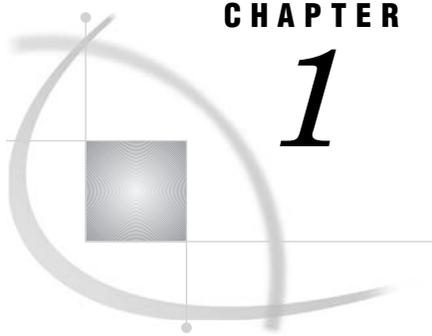
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Concepts

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CHAPTER

1

Overview of Application Messaging

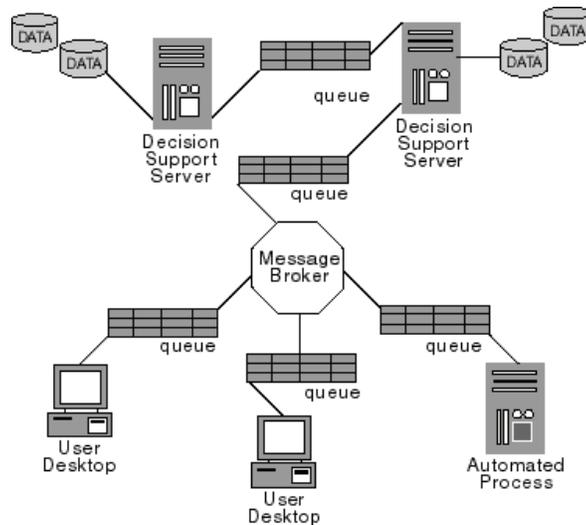
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Application Messaging Overview

Application messaging architectures provide a platform that supports interoperability among loosely coupled applications over a message passing bus. When the targeted scope of interoperability is broad (for example, spanning multiple application systems and organizational boundaries), application messaging architectures might be required. This is because the likelihood of conformance in the software implementation base (for example, the selected distributed object standard) across the set of participating applications is diminished. Additionally, the set of participating applications can exhibit asynchronous, disconnected operation. These applications execute with no direct point-to-point communication session. However, they require guaranteed fulfillment of requests for service or event delivery.

This degree of operational heterogeneity introduces several requirements that are reflected in the application messaging infrastructure. Heterogeneity in the implementation base of the various applications (including perhaps, retrofitted legacy applications) suggests a need for a reasonably nonintrusive integration mechanism. The semantics of application messaging satisfy this need, generally expressing open, close, send, and receive functionality with flexible application-defined message structures. Heterogeneity with respect to the asynchronous, disconnected execution and notification modes of end-point participants introduces requirements for service qualities that include routing, assured just-once delivery, and retained sequencing. The architecture that has emerged within commercial application messaging products to express these quality-of-service properties is *store-and-forward queuing*.

In a store-and-forward model, messages are sent to named queues, which are in turn hosted at specific destination network addresses. The navigation of messages from their origin occurs through a transmission network that ensures the integrity of message delivery to the destination queue and presentation to the recipient process.

Display 1.1 The Store and Forward Messaging Model

Ever more frequently, the simple design pattern of two identifiable applications that interoperate over a message passing bus is inconsistent with the realities of an event-driven enterprise. Interdependencies across multiple applications with respect to events that occur within an enterprise combined with an ever-changing topology of event supplier and consumer applications are often present. Decision-makers require information pertinent to their domain of responsibility regardless of the reporting applications. Automated business processes require modification in rapid response to changing operational conditions. The ability to satisfy these requirements in a timely manner, and thereby reduce the latencies too common in information interchange, is critical to efficient and effective enterprise performance.

To support such dynamism, extended application messaging infrastructure facilities in the form of message brokers are emerging. Message brokers are being effectively positioned as enterprise application integration and event-management focal points, which function as hub processes that manage the information flow throughout an enterprise. Operationally, message brokers provide rules-based message routing and distribution as well as message transformation and augmentation capabilities that enable the removal of this aspect of implementation logic from participating applications.

Interfaces to three principal commercial messaging platforms, IBM WebSphere MQ (previously named MQSeries), Microsoft MSMQ, and TIBCO Software TIB/Rendezvous (including the Certified Message Delivery transport) are provided with SAS Integration Technologies. Support for these platforms enables SAS software's information delivery capabilities to be leveraged within various enterprise solution scenarios, including application integration, asynchronous and mobile synchronization, and event notification.

Support for client environments is broad. IBM provides WebSphere MQ on a vast array of operating system platforms with programming language support including C/C++, Java, and Cobol as well as ActiveX control support that enables Visual Basic participation. The Enterprise Java JMS facility also anticipates a provider for WebSphere MQ. Likewise, Microsoft provides full language support for MSMQ.

Supported Platforms for the SAS Messaging Interfaces

WebSphere MQ Functional Interface and the SAS Common Messaging Interface

The SAS interfaces to WebSphere MQ version 6 and later are supported for the following platforms:

- all supported UNIX platforms
- all supported 32-bit Windows platforms
- Windows on x64 (WebSphere MQ version 7 and later only)
- z/OS

The SAS interfaces to WebSphere MQ Client version 6 and later are supported in the following platforms:

- all supported UNIX platforms
- all supported 32-bit Windows platforms
- Windows on x64 (WebSphere MQ version 7 and later only)

MSMQ Functional Interface

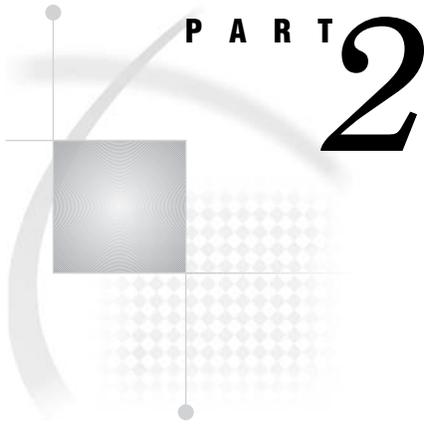
The SAS interfaces to Microsoft Message Queuing Services (MSMQ) are supported on all of the 32-bit and 64-bit Windows platforms that are supported by SAS.

TIB/Rendezvous

SAS Integration Technologies supports both the reliable and certified message delivery features of TIB/Rendezvous Release 7.5.4 and later.

Support for using TIB/Rendezvous with the SAS Common Messaging Interface is available in the following operating environments:

- all supported UNIX platforms
- all supported 32-bit Windows platforms

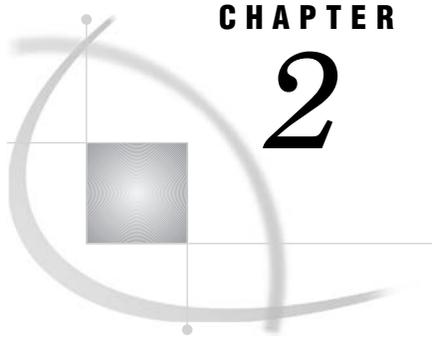


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CHAPTER

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Configuring WebSphere MQ with the WebSphere MQ Explorer

Configure a Queue Manager

Before you use the WebSphere MQ applications, you must create a queue manager. The queue manager is a system program that is responsible for maintaining the queues and ensuring that the messages in the queues reach their destination. It also performs other functions that are associated with message queuing.

A queue is a named destination that applications use to send and receive messages. A queue name must be unique within a queue manager. Special queue types can be defined, such as transmission queues and dead letter queues.

- A transmission queue is a queue that holds messages that will eventually be sent to a remote queue when a communication channel becomes available. Unless otherwise specified, these messages are transmitted through the default transmission queue.
- A dead letter queue is a local queue where messages that cannot be delivered are sent, either by the queue manager or an application. Some method should be in place in production environments to monitor and process messages in this queue.

To configure a queue manager, perform the following steps:

- 1 From the WebSphere MQ Explorer window, expand the **WebSphere MQ** node, and then right-click **Queue Managers**. Select **New ► Queue Manager** from the pop-up menu.
- 2 Enter the name for your queue manager. The examples in this section use the name **MYQMGR**. Fill in names for the default transmission queue and dead letter queue. Select **Make this the default queue manager**.

Note: All names in WebSphere MQ are case sensitive. △

Click **Next** to continue.

- 3 Click **Next** to accept the default values for the logging options.
- 4 Verify that **Start Queue Manager** is selected.
Click **Next** to continue.
- 5 Make sure that **Create listener configured for TCP/IP** is selected, and enter **1414** for the port number. This is the default port number for WebSphere MQ. Check with your system administrator to verify that this is the correct port to use.
Click **Finish** to create your queue manager. It might take a minute to create and start the queue manager.

Define Queues

Create one or more local queues for exchanging messages on your queue manager. These are the queues that SAS applications will use to exchange messages with other applications.

To define a queue, perform the following steps:

- 1 In the WebSphere MQ Explorer, locate your queue manager and expand the menu. Right-click **Queues**, and then select **New ► Local Queue** from the popup menu. The Create Local Queue window appears.
- 2 In the **Queue Name** field, enter the name of the local queue that you want to create. This queue name is specified in any application programs that use WebSphere MQ. You might also want to change the **Default Persistence** value from **Not Persistent** to **Persistent**. Setting a value of **Persistent** enables messages to remain in the queue even if the queue manager is shut down. Click each tab to see the types of values that can be defined.
- 3 (Optional) If you use high-volume messaging applications like scoring, then select the **Extended** tab and increase the value of **Maximum Queue Depth** to **100,000** or more. The value of **Maximum Queue Depth** represents the maximum number of messages that a queue can hold.
- 4 Click **OK** to create the queue. Repeat the process for any additional local queues that you want to create.

You should also create the dead letter queue that is specified in the queue manager definition. If you will be exchanging messages with queues on other queue managers,

then create the default transmission queue. For information about configuring channels and transmission queues, see the IBM WebSphere MQ documentation.

At this point, WebSphere MQ has enough information for you to run applications that use message queuing locally within your machine through a single queue manager.

Configuring WebSphere MQ Client Access

Overview of Configuring Client Access

IBM provides a lighter client version of WebSphere MQ that can be installed and used separately from the full WebSphere MQ Base or server installation. The client can be installed on the same machine as the server or on a separate machine. The client does not have its own queue manager and must communicate over the network or within a machine to a queue manager that is defined elsewhere.

To configure client access, perform the following steps:

- 1 Define a server connection channel to support the client.
- 2 Install the WebSphere MQ Client software on the client machine.
- 3 Define the queue manager connection on the client machine.

Define a Server Connection Channel

You must define a server connection channel on the queue manager that will provide support to the client. A channel is a definition that enables intercommunication between queue managers, or between clients and queue managers.

To define a server connection channel, perform the following steps:

- 1 In WebSphere MQ Explorer, select a queue manager and then select **Advanced**.
- 2 Right-click **Channels**, and then select **NEW ► Server Connection Channel**. The Create Server Connection Channel window appears.
- 3 Specify the name of the channel and an optional description, and then click **OK** to save the channel.

Install the WebSphere MQ Client

The WebSphere MQ Client must be installed and configured on the client machine. The WebSphere MQ Client is included as part of the typical installation.

Define the Queue Manager Connection on the Client Machine

You can use the following methods to define the connection from the client to the queue manager:

- Set the MQSERVER environment variable. The following code is an example of how to set this variable on Windows:

```
set MQSERVER=ChannelName/TransportType/ConnectionName
```

Here is an example:

```
set MQSERVER=SERVER.CHANNEL1/TCP/server_address(port)
```

In this example, *server_address* is the TCP/IP host name (either the IP address or complete host name) of the server, and *port* is the number of the TCP/IP port on which the server is listening. The port is defined when you create the queue manager. The default port number is 1414. Here is an example:

```
set MQSERVER=SERVER.CHANNEL1/TCP/1.2.3.4(1414)
```

- Create a client channel definition table, and set the MQCHLLIB and MQCHLTAB environment variables to identify the location of the table.

For more information, see the WebSphere MQ documentation at www.ibm.com.

Use the Configured Values in a SAS DATA Step Application

The queue and queue manager values are required in SAS applications that use the WebSphere MQ functional interface. In the previous examples, the queue manager is named MYQMGR, and the queue is named REQUEST. These values are used as follows in the SAS DATA step application:

```
hConn=0;
Name="MYQMGR";
compCode=0;
reason=0;
CALL MQCONN(Name, hConn, compCode, reason);

action = "GEN";
parms="OBJECTNAME";
objname="REQUEST";
call mqod(hod, action, rc, parms, objname);

options="INPUT_SHARED";
call mqopen(hconn, hod, options, hobj, compCode, reason);
```

If a SAS application is running as a WebSphere MQ Client, then you must include the following line of code before making any calls using the WebSphere MQ Functional Interface. This line should be placed at the beginning of the application, before the DATA step, as shown in the following example:

```
%let MQMODEL=CLIENT;
data _null_;
...
run;
```

Table 2.1 Common WebSphere MQ Application Error Codes

Reason Code	Explanation	Suggested Action
2018	A connection handle is invalid.	A connection handle that is created by an MQCONN call must be used within the same DATA step where it was created.
2035	The user is not authorized to perform the attempted action.	Verify that you are connecting to the correct queue and queue manager. Verify that you are authorized to connect to the queue manager. If error is reported to a client connecting to a queue manager, you might need to set the user ID under the MCA tab in the server connection channel definition properties to a user ID that has permission to access the queue manager on the server machine.
2058	There is an error in the queue manager name.	Check spelling and case of the queue manager name that is used in the application and is defined in the queue manager.
2059	The queue manager is not available.	Restart the queue manager.
2085	The object name is unknown.	Check spelling and case of the queue name that is used in the application and is defined in the queue manager.
Others		See <i>WebSphere MQ Messages</i> at www.ibm.com .

Using Message Queue Polling with WebSphere MQ

Overview of Message Queue Polling

You can use a message queue polling server to monitor queues and to start SAS programs. This feature can be useful when you want to deploy the WebSphere MQ Functional Interface in high-volume, time-sensitive situations.

Message queue polling is most useful for DATA step applications that retrieve messages from an MQSeries message queue and for incoming messages that are independent of each other. Reply messages can be sent, but this feature should not be used to start programs that are primarily used to send messages.

For information about configuring the message queue polling server, see Appendix 1, “Configuring Message Queue Polling,” on page 255.

Environment Variables for the Polling Server

Environment Variables that Are Set Automatically

When a polling server session is started, the object spawner automatically creates the following environment variables for the session:

SASQSID

specifies the unique identifier for the object spawner.

SASQUEUE

specifies the name of the queue for the polling server.

SASQMGR

specifies the name of the queue manager that the polling server uses to access the queue.

Specifying Environment Variables on the SAS Command

You can also set environment variables on the server by using the `-SET` option on the SAS command for the server session. For example, you might want to specify the queue model by using the `MQMODEL` variable. The following SAS command sets the queue model to `client` and sets the `MQSERVER` variable to enable remote access:

```
sas -sysin "myfile.sas" -set MQMODEL client
    -set MQSERVER "CHANNEL1/TCP/192.168.0.10(1414)"
```

Retrieving Environment Variable Values

You can retrieve the values of the environment variables by using the `SYSGET()` function. For example, the following code retrieves the `SASQMGR` value and stores it in the `QMGR` variable:

```
qmgr= sysget('SASQUEUE');
```

You can also use the `%SYSGET` macro function. Here is an example:

```
%let qmgr=%sysget(SASQUEUE);
```

On z/OS, if you use a UNIX shell script to invoke SAS, then you must use the `-SET` invocation option to retrieve the environment variables within the script and pass them to the SAS session. For example:

```
-set \"SASQSID ${SASQSID}\" -set \"SASQMGR ${SASQMGR}\"
```

Checking for Stop Messages

The message queue polling server uses SAS sessions to perform processing. These sessions are managed by the object spawner. When the object spawner is stopped, it puts high-priority stop messages on the message queue for each server session that it started. Each stop message contains a unique identifier string that identifies the spawner. By setting the `SASQSID` in the get message options (on the `MQGMO CALL` routine), the `MQGET` call will check for this message. If the message is found, and the `SASQSID` value matches the identifier in the message, then `MQGET` returns a completion code of 2 and a reason code of -2. The `DATA` step program must check for this, perform cleanup, and close immediately upon receiving the stop message.

The SASQSID value is passed to the polling server by the object spawner as an environment variable. For more information, see “Environment Variables for the Polling Server” on page 14.

For queues that are monitored by the message queue polling server, the `MsgDeliverySequence` property must be set to **Priority**.

The following code fragment shows an MQGET call that checks for a stop message:

```
call mqget(hconn, hobj, hmd, hgmo, msglen, cc, reason);
  if cc ^= 0 then do;
    if reason = 2033 then do;
      put 'No message available';
    end;
  else do;
    if reason = -2 then do;
      put "MQGET: received stop message from object spawner";
      goto exit;
    end;
  else put 'MQGET: failed with reason= ' reason;
  end;
end;
else put 'MQGET: message received: ';
```

Message Queue Polling Example

The following code is a sample application that you can run with message queue polling.

```
data _null_;
length hconn hobj cc reason 8;
length rc hod hgmo hmd hmap msglen 8;
length parms $ 200 options $ 200 action $ 3 msg $ 200;
length desc $ 50;

msglen=0;
hconn=0;
hobj=0;
hod=0;
hgmo=0;
hmd=0;
hmap=0;

/* Get the variables set by the object spawner for this session */
sid = sysget('SASQSID');
qmgr= sysget('SASQMGR');
qname= sysget('SASQUEUE');

put "Spawner job started.";
put "sid = " sid;
put "qmgr = " qmgr;
put "qname = " qname;

call mqconn(qmgr, hconn, cc, reason);

action = "GEN";
parms="OBJECTNAME";
```

```

objname=qname;
call mqod(hod, action, rc, parms, objname);
if rc ^= 0 then do;
    put 'MQOD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

options="INPUT_SHARED";
call mqopen(hconn, hod, options, hobj, cc, reason);
if cc ^= 0 then do;
    put 'MQOPEN: failed with reason= ' reason;
    goto exit;
end;

parms= "SASQSID";
call mqgmo(hgmo, action, rc, parms, sid);
if rc ^= 0 then do;
    put 'MQGMO: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

desc="CHAR,,100";
call mqmap(hmap, rc, desc);
if rc ^= 0 then do;
    put 'MQMAP: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

reason = 0;
do until (reason = 2033);

    action = "GEN";
    call mqmd(hmd, action, rc);
    if rc ^= 0 then do;
        put 'MQMD: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
    end;

    call mqget(hconn, hobj, hmd, hgmo, msglen, cc, reason);
    if cc ^= 0 then do;
        if reason = 2033 then do;
            put 'No message available';
        end;
        else do;
            if reason = -2 then do;
                /* -2 indicates that a session-specific stop message has */
                /* been received from the object spawner queue monitor */
            end;
        end;
    end;
end;

```

```

        /* application. We should clean up and shutdown immediately. */
        put "MQGET: received stop message from object spawner";
        goto exit;
    end;
    else put 'MQGET: failed with reason= ' reason;
    end;
end;
else put 'MQGET: message received: ';

/* Do any application-specific processing of messages here. */

if hmd ^= 0 then do;
    call mqfree(hmd);
end;

end; /* end do loop */

exit:
if hobj ^= 0 then do;
    options="NONE";
    call mqclose(hconn, hobj, options, cc, reason);
    if cc ^= 0 then do;
        put 'MQCLOSE: failed with reason= ' reason;
    end;
end;

if hconn ^= 0 then do;
    call mqdisc(hconn, cc, reason);
    if cc ^= 0 then do;
        put 'MQDISC: failed with reason= ' reason;
    end;
end;

if hod ^= 0 then do;
    call mqfree(hod);
end;
if hgmo ^= 0 then do;
    call mqfree(hgmo);
end;
if hmd ^= 0 then do;
    call mqfree(hmd);
end;
if hmap ^= 0 then do;
    call mqfree(hmap);
end;

run;

```

Configure Multiple Clients to Read from a Single Queue

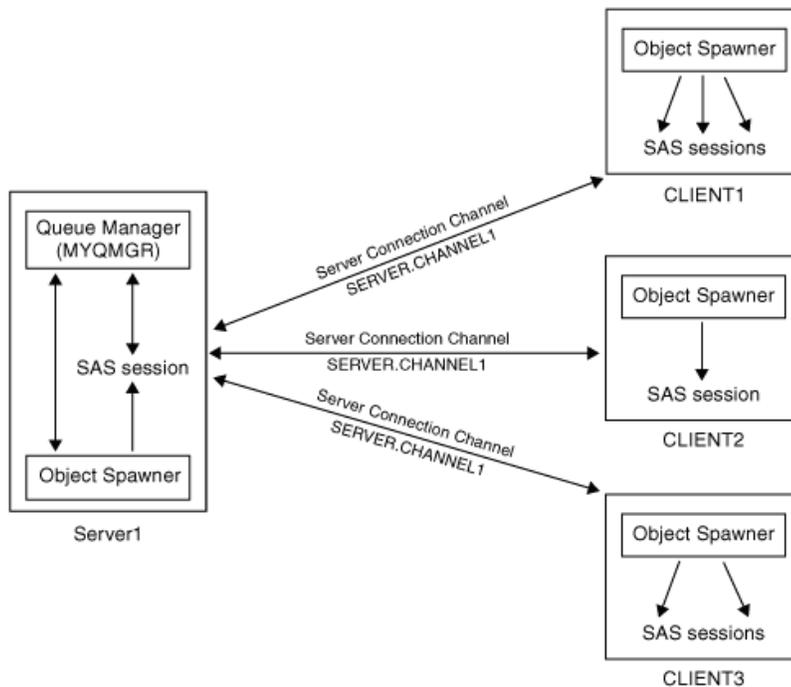
The WebSphere MQ interfaces and the message queue polling feature of the object spawner can be used to distribute the processing of messages on a message queue

across one or more machines. The result is enhanced performance, load balancing, and hardware redundancy.

Messages can be retrieved only from local queues. In order to enable multiple machines to process messages on a single queue, you must have a full WebSphere MQ (server) installation on the machine that will act as the server. The WebSphere MQ Clients use the queue manager on the server as their queue manager, so any local queues that are defined on that queue manager are also local to the client installations. The WebSphere MQ Clients can connect to a WebSphere MQ server on any supported platform. Message queuing applications on the machine where the queue manager is installed can access the queues directly. Message queuing applications do not need to be configured as clients.

The following diagram illustrates a sample configuration. The queue manager (MYQMGR) is running on Server1 and is managing the queue for each of the WebSphere MQ Clients (CLIENT1, CLIENT2, and CLIENT3). All three clients are communicating with the queue manager through the same server connection channel (SERVER.CHANNEL1). The object spawners on each of the clients can start one or more SAS sessions as needed in order to receive messages from the queue. SAS sessions can also be started by the object spawner and run on the server. A SAS session running on the server does not need to run as a WebSphere MQ Client application; it behaves as a WebSphere MQ server application.

Display 2.1 Example Messaging Configuration



To configure the queue manager on the server, perform the following steps:

- 1 Define a queue manager if this has not already been done. In the following example, the queue manager is called MYQMGR.

```
crtmqm MYQMGR
```

- 2 Start the queue manager by using the WebSphere MQ Explorer (Windows platforms). You can also use the following command on the command line:

```
strmqm MYQMGR
```

3 Define one or more local queues that will be used by the applications.

- To define a local queue from the command line, start the WebSphere MQ command program MQSC. Here is an example:

```
runmqsc MYQMGR
DEFINE QLOCAL(LOCAL) DEFPSIST(YES) DESCR('Local Queue')
```

Type **end** to exit MQSC.

- To define a local queue from the WebSphere MQ Explorer, click MYQMGR to expand the list. Right-click **queues**, select **New ► Local Queue** and enter the queue name and properties.

4 Define a server connection channel to enable WebSphere MQ Clients to communicate with MYQMGR. You can also define a separate server connection channel for each client.

- To define a server connection channel from the command line, start the WebSphere MQ command program MQSC. Here is an example:

```
runmqsc MYQMGR
DEFINE CHANNEL(SERVER.CHANNEL1) CHLTYPE(SVRCONN)
TRPTYPE(TCP) + MCAUSER(' ') DESCR('Server
connection channel for Client1')
```

Type **end** to exit MQSC.

- To define a server connection channel from the WebSphere MQ Explorer, click **MYQMGR ► Advanced** to expand the list. Right-click **Channels**, select **NEW ► Server Connection Channel** and enter the channel name.

5 On each client, install and configure the WebSphere MQ Client. Use the MQSERVER environment variable to define the client connection to the server. The following code shows examples of how to do this in Windows and UNIX operating environments.

- For Windows, use the following code:

```
set MQSERVER=ChannelName/TransportType/ConnectionName
```

Here is an example:

```
set MQSERVER=SERVER.CHANNEL1/TCP/server_address(port)
```

where *server_address* is the TCP/IP host name of the server and *port* is the number of the TCP/IP port on which the server is listening. The default port number is 1414. Here is an example:

```
set MQSERVER=SERVER.CHANNEL1/TCP/10.12.0.0(1414)
```

- For UNIX, use the following code:

```
export MQSERVER=ChannelName/TransportType/ConnectionName
```

Here is an example:

```
export MQSERVER=SERVER.CHANNEL1/TCP/'10.12.0.0(1414)'
```

6 The queue and queue manager values are required in SAS applications that use the WebSphere MQ functional interface. In the previous examples, the queue manager is named MYQMGR, and the queue is named LOCAL. These values are used as follows in the SAS DATA step application:

```
hConn=0;
Name="MYQMGR";
compCode=0;
```

```

reason=0;
CALL MQCONN(Name, hConn, compCode, reason);

action = "GEN";
parms="OBJECTNAME";
objname="LOCAL";
call mqod(hod, action, rc, parms, objname);

options="INPUT_SHARED";
call mqopen(hconn, hod, options, hobj, compCode, reason);

```

If a SAS application is running as a WebSphere MQ Client, then you must include the following line of code before making any calls that use the WebSphere MQ Functional Interface. This line should go at the beginning of the application before the DATA step:

```

%let MQMODEL=CLIENT;
data _null_;
...
run;

```

This example provides basic configuration information for configuring several clients to receive messages from a queue on one server.

For more information, see the WebSphere MQ documentation at www.ibm.com.

Configuring WebSphere MQ to Trigger SAS: An Example

Introduction

SAS Integration Technologies provides two interfaces that can be used to send and receive messages with WebSphere MQ, the Common Messaging Interface, and the WebSphere MQ Interface. WebSphere MQ (formerly called MQSeries) enables you to trigger, or start, an application automatically when a message arrives on a message queue. There are many situations where it is useful to have a SAS DATA step application started when a message arrives on a specific queue. However, SAS cannot be started directly by the trigger monitor. An intermediate batch job is started by WebSphere MQ, and this batch job calls SAS. The details of one such configuration and batch job are included here.

The following example shows a SAS client that runs on Windows XP and uses WebSphere MQ to communicate with a SAS server that runs on AIX. This SAS client sends a message to a queue and queue manager on AIX. When the message arrives on the queue, it triggers a batch job that starts the SAS server to receive the message and return the requested data set. The WebSphere MQ Client can connect to a WebSphere MQ server on any supported platform. WebSphere MQ requires that the trigger monitor and the application to be started be on the same system, but they can be on either the client or the server. The process definition, which defines the application to be triggered, must be defined on the WebSphere MQ server. In this example, the WebSphere MQ Queue Manager (server installation) is on the same AIX system as the WebSphere MQ Client.

For more information about triggering, see the WebSphere MQ Client documentation at www.ibm.com.

The following two sample programs demonstrate the triggering process:

- “mqclient.sas” on page 24
- “mqserver.sas” on page 27

The SAS DATA step `mqclient.sas` runs on the XP machine and requests a data set. The `mqserver.sas` program is triggered by the `startsas` batch program that is described below. It runs on the AIX machine. The `mqserver.sas` program reads the message off of the queue and returns the requested data set.

Configuration on the Windows XP Machine

The trigger samples assume that the following configuration objects have been created on the Windows machine:

- a queue manager named XPQMGR
- a local queue named REPLY, with the following settings:

Table 2.2 Configuration Settings for the Local Queue

Queue Name	REPLY
Type	Local
Put Messages	Allowed
Get Messages	Allowed
Default Priority	0
Default Persistence	Not Persistent
Scope	Queue Manager
Usage	Normal

- a remote queue named AIX.TRIGQUEUE, with the following settings:

Table 2.3 Configuration Settings for the Remote Queue

Queue Name	AIX.TRIGQUEUE
Type	Remote
Put Messages	Allowed
Default Priority	0
Default Persistence	Not Persistent
Scope	Queue Manager
Remote Queue Name	TRIGQUEUE
Remote Queue Manager Name	AIX
Usage	XMITQ

- a receiver channel named XPQMGR.CHANNEL, with the following settings:

Table 2.4 Configuration Settings for the Receiver Channel

Channel Name	XPQMGR.CHANNEL
Type	Receiver
Transmission Protocol	TCP/IP

- a sender channel named AIX.CHANNEL, with the following settings:

Table 2.5 Configuration Settings for the Sender Channel

Channel Name	AIX.CHANNEL
Type	Sender
Transmission Protocol	TCP/IP
Connection Name	<i>AIX-machine-name</i>
Transmission Queue	XMITQ

- a process definition named AIX.PROCESS, with the following settings:

Table 2.6 Configuration Settings for the Process Definition

Process Definition Name	AIX.PROCESS
Application Type	Windows NT
User Data	AIX.CHANNEL

- a transmission queue named XMITQ, with the following settings:

Table 2.7 Configuration Settings for the Transmission Queue

Queue Name	XMITQ
Type	Local
Put Messages	Allowed
Get Messages	Allowed
Default Priority	0
Default Persistence	Not Persistent
Scope	Queue Manager
Usage	Transmission
Trigger Control	On
Trigger Type	First
Trigger Depth	0
Trigger Message Priority	0

Initiation Queue Name	CHANNEL.INITQ
Process Name	AIX.PROCESS

Configuration on the AIX Machine

The following code can either be a part of a configuration file, or stanzas that can be entered in the **runmqsc** tool. Modify the following templates and use the WebSphere MQ tool **runmqsc** to define the required objects on a queue manager that is named AIX for this example:

```
* Local Queue that triggers the batch job to start SAS
DEFINE QLOCAL(TRIGQUEUE) +
  REPLACE DEFPSIST(YES) DESCR('TRIGQUEUE Queue') +
  INITQ(MY.INITQ) +
  TRIGGER TRIGTYPE(EVERY) PROCESS(TRIGSAS.PROCESS)
* TRIGTYPE can also be FIRST or DEPTH. EVERY will trigger
* the batch job every time a message arrives on the queue.

* Process to start the batch file that starts SAS
DEFINE PROCESS (TRIGSAS.PROCESS) +
  REPLACE APPLICID('/users/userid/startsas') APPLTYPE(UNIX)

DEFINE QLOCAL(MY.INITQ)

* Receiver Channel for AIX Queue Manager
DEFINE CHANNEL(AIX.CHANNEL) CHLTYPE(RCVR) +
  REPLACE DESCR('Receiver Channel on AIX') +
  TRPTYPE(TCP)

*--- remote definitions for Windows XP queue manager ---*

* Remote Queue at XPQMGR
DEFINE QREMOTE(XPQMGR.REPLY) +
  REPLACE RNAME(REPLY) RQMNAME(XPGMGR) XMITQ(XPQMGR.XMITQ)

* Transmission Queue
DEFINE QLOCAL(XPQMGR.XMITQ) +
  REPLACE DESCR('Transmit Queue to XP system') +
  USAGE(XMITQ) TRIGGER TRIGTYPE(FIRST) +
  INITQ(SYSTEM.CHANNEL.INITQ) PROCESS(XPQMGR.PROCESS)

* Process definition for XMITQ trigger
DEFINE PROCESS(XPQMGR.PROCESS) +
  REPLACE DESCR('Process definition +
    to start XPQMGR Channel') +
  USERDATA('XPQMGR.CHANNEL')

* Sender Channel - started automatically
* when first message written to XMITQ
DEFINE CHANNEL(XPQMGR.CHANNEL) CHLTYPE(SDR) +
  REPLACE DESCR('Sender Channel to XPQMGR') +
  TRPTYPE(TCP) XMITQ(XPQMGR.XMITQ) +
  CONNAME('XPMACHINE.MYLOCATION.MYCOMPANY.COM')
```

```

*----- Setup Client/Server Server Connection Channel -----*
  DEFINE CHANNEL(MQCLIENT.CHANNEL) +
  CHLTYPE(SVRCONN) TRPTYPE(TCP) +
  REPLACE DESCR('Server connection for client access') +
  MCAUSER(' ')

```

This example uses `/users/userid/startsas` as the name of the batch file triggered to run a SAS DATA step. The contents of this file are:

```

# Make sure the 64-bit WebSphere MQ client
# libraries are in your LIBPATH.
export LIBPATH=/usr/mqm/lib64

# Define the server that the SAS WebSphere MQ
# client interface will connect through.
export MQSERVER=
  MQCLIENT.CHANNEL/TCP/'<server IP address>(port)'

sas -sysin /users/userid/mqserver.sas

```

You must also make sure that the trigger monitor has been started on the AIX machine for the proper initiation queue:

```
runmqsc -m AIX -q MY.INITQ
```

Sample Trigger Programs

mqclient.sas

The following program runs on the Windows XP machine and requests a data set:

```

data _null_;

  length msg $ 200;
  length qid2 tid rc 8;
  length map $80;
  length recvl $50;
  length event $10;
  length rpname $256;
  length type $8;
  length qual1 qual2 $40;

  libname out '.';
  tid=0;
  rc=0;
  put '-----';
  put 'Call INIT';
  CALL INIT(tid, 'MQSERIES', rc);
  if rc ^= 0 then do;
    put 'INIT: failed';
    msg = sysmsg();
    put msg;
  end;

```

```

end;
else put 'INIT: succeeded';

rc=0;
qid=0;
put '----';
put 'Call OPENQUEUE to open the response queue';
CALL OPENQUEUE(qid, tid, 'XPQMGR:REPLY', 'fetch',
rc, "POLL(TIMEOUT=20)");
if rc ^= 0 then do;
put 'OPENQUEUE: failed';
msg = sysmsg();
put msg;
end;
else put 'OPENQUEUE: succeeded';

rc=0;
qid2=0;
put 'Call OPENQUEUE to open the request queue on qid2';
CALL OPENQUEUE(qid2, tid, 'XPQMGR:AIX.TRIGQUEUE',
'DELIVERY', rc, "POLL(Timeout=15)");
if rc ^= 0 then do;
put 'OPENQUEUE: failed';
msg = sysmsg();
put msg;
end;
else put 'OPENQUEUE: succeeded';

rc=0;
put '----';
put 'Call SETMAP';
CALL SETMAP('mqclientmap', 'REGISTRY', rc, 'CHAR,,50');
if rc ^= 0 then do;
put 'SETMAP: failed';
msg = sysmsg();
put msg;
end;
else put 'SETMAP: succeeded';

parml="calories";
put '---- Send a message to the request queue qid
requesting the specified data set ----';
put 'Call SENDMESSAGE';
call sendmessage(qid2,rc,"map, respqueue",
"mqclientmap","R64:D8650",parml);
if rc ^= 0 then do;
put 'send message failed: ';
msg=sysmsg();
put msg;
end;
else put 'send message succeeded';

slept = sleep(1);
rc = 0;

```

```

put '---- receive a data set from the reply queue ----';
put 'Call RECEIVEMESSAGE';
map = "mqclientmap";
call receivemessage(qid, rc, event,
    attchflg,"map", map, recv1);
put 'response queue =' rpname;
put 'qid =' qid;
put 'event = ' event;
put 'attchflg =' attchflg;
if rc ^= 0 then do;
    put 'receive message failed: ';
    msg=sysmsg();
    put msg;
end;
else do;
    put 'receive message succeeded';
    put "map =" map;
put "recv1 =" recv1;
end;

if event eq 'DELIVERY' then
do;
    put 'Message has been delivered';
    if attchflg = 1 then
do;
        put '---- check for attachments ----';
        call getattachment(qid, lastflag, attachid,
            type, qual1, qual2, rc);
        if rc ^= 0 then do;
            put 'get attachment failed: ';
            msg=sysmsg();
            put msg;
            end;
        else put 'get attachment succeeded';

        if type="DATASET" then
do;
            put '--- accept attachment into a data set ---';
put "qual2 = " qual2;
            call acceptattachment(qid, attachid,
                "out", qual2, rc);
            if rc ^= 0 then do;
                put 'accept DATASET failed: ';
                msg=sysmsg();
                put msg;
            end;
            else put 'accept DATASET succeeded';
        end;
    end;
end;

rc=0;
put '----';
put 'Call CLOSEQUEUE for queue1';

```

```

CALL CLOSEQUEUE(qid, rc);
if rc ^= 0 then do;
    put 'CLOSEQUEUE: failed';
    msg = sysmsg();
    put msg;
end;
else put 'CLOSEQUEUE: succeeded';

rc=0;
put '----';
put 'Call CLOSEQUEUE for queue2';
CALL CLOSEQUEUE(qid2, rc);
if rc ^= 0 then do;
    put 'CLOSEQUEUE: failed';
    msg = sysmsg();
    put msg;
end;
else put 'CLOSEQUEUE: succeeded';

rc=0;
put '----';
put 'Call TERM';
CALL TERM(tid, rc);
if rc ^= 0 then do;
    put 'TERM: failed';
    msg = sysmsg();
    put msg;
end;
else put 'TERM: succeeded';

run;

```

mqserver.sas

The following program runs on the AIX machine and returns a data set:

```

data calories;
    input item $ 1 - 16 calories 18-20 ;
    datalines;
ground beef      230
hot dog          100
banana           100
broccoli         45
skim milk        50
;

data _null_;

    length msg $ 200;
    length qid qid2 tid rc 8;
    length map $80;
    length recv1 $50;
    length attachname $21;

```

```

length event $10;
length rpname $256;
tid=0;
rc=0;

put '----';
put 'Call INIT';
CALL INIT(tid, 'MQSERIES-C', rc);
if rc ^= 0 then do;
    put 'INIT: failed';
    msg = sysmsg();
    put msg;
end;
else put 'INIT: succeeded';

rc=0;
qid=0;
put '----';
put 'Call OPENQUEUE for queue1';
CALL OPENQUEUE(qid, tid, 'AIX:TRIGQUEUE',
    'fetch', rc, "POLL(Timeout=10)");
if rc ^= 0 then do;
    put 'OPENQUEUE: failed';
    msg = sysmsg();
    put msg;
end;
else put 'OPENQUEUE: succeeded';

rc=0;
put '----';
put 'Call SETMAP';
CALL SETMAP('mqservermap', 'REGISTRY', rc, 'CHAR,,50');
if rc ^= 0 then do;
    put 'SETMAP: failed';
    msg = sysmsg();
    put msg;
end;
else put 'SETMAP: succeeded';

rc = 0;
put '---- receive a message from the remote queue ----';
put 'Call RECEIVEMESSAGE';

map = "mqservermap";
rpname=' ';
call receivemessage(qid, rc, event, attchflg,"map,
    respqueue", map, rpname, recv1);
put 'recv1 =' recv1;
put 'response queue =' rpname;
put 'qid =' qid;
put 'event = ' event;
put 'attchflg =' attchflg;

if rc ^= 0 then do;

```

```

    put 'receive message failed: ';
    msg=sysmsg();
    put msg;
end;
else do;
    put 'receive message succeeded';
    put map;
end;

if event eq 'DELIVERY' then
do;
    rc = 0;
    qid2=0;

    put '---- open the response queue qid2 ----';
    put 'Call OPENQUEUE for queue2';
    CALL OPENQUEUE(qid2, tid, rpname, 'delivery',
        rc, "POLL(Timeout=15)");
    if rc ^= 0 then do;
        put 'OPENQUEUE: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'OPENQUEUE: succeeded';
    put 'rpname = ' rpname;

    put '---- send the requested data set
        to the response queue ----';
    put 'Call SENDMESSAGE';
    attachname = 'dataset,work,' || recv1;
    put "attachname = " attachname;
    call sendmessage(qid2,rc,"map, attachlist",
        "mqservermap",attachname, recv1 );
    if rc ^= 0 then do;
        put 'send message failed: ';
        msg=sysmsg();
        put msg;
    end;
    else put 'send message succeeded';

    rc=0;
    put '----';
    put 'Call CLOSEQUEUE for queue2';
    CALL CLOSEQUEUE(qid2, rc);
    if rc ^= 0 then do;
        put 'CLOSEQUEUE: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'CLOSEQUEUE: succeeded';
end;

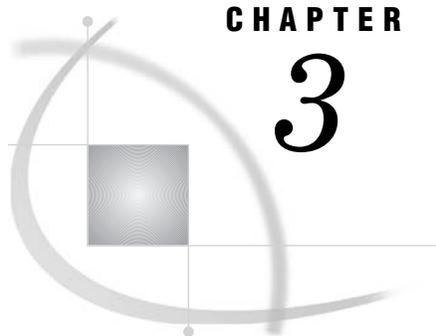
rc=0;
put '----';

```

```
put 'Call CLOSEQUEUE for queue1';
CALL CLOSEQUEUE(qid, rc);
if rc ^= 0 then do;
    put 'CLOSEQUEUE: failed';
    msg = sysmsg();
    put msg;
end;
else put 'CLOSEQUEUE: succeeded';

rc=0;
put '----';
put 'Call TERM';
CALL TERM(tid, rc);
if rc ^= 0 then do;
    put 'TERM: failed';
    msg = sysmsg();
    put msg;
end;
else put 'TERM: succeeded';

run;
```



CHAPTER

3

Using IBM WebSphere MQ

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WebSphere MQ Functional Interface

SAS Integration Technologies allows application developers to combine the power of both SAS information delivery and IBM message queuing capabilities by providing a SAS interface to the IBM WebSphere MQ product (formerly called MQSeries). With this interface, SAS programs can create new WebSphere MQ message queues or take advantage of existing ones that are available throughout the enterprise. This section explains how to implement this interface by using the SAS DATA step and SAS Macro Language.

Note: WebSphere MQ enables you to trigger, or start, an application automatically when a message arrives on a message queue. For more information, see “Configuring WebSphere MQ to Trigger SAS: An Example” on page 20. Δ

Writing WebSphere MQ Applications

Overview of Writing WebSphere MQ Applications

With WebSphere MQ messaging, two or more applications communicate with each other indirectly and asynchronously using message queues. The applications do not have to be running at the same time or even in the same operating environment. An application can communicate with another application by sending a message to a queue. The receiving application retrieves the message when it is ready.

A typical SAS program using WebSphere MQ services performs the following tasks:

- 1 Establishes a connection to a WebSphere MQ queue manager. The queue manager is responsible for maintaining the queues and for ensuring that the messages in the queues reach their destination. This insulates the application developer from the details of the network. When a successful connection is made, the queue manager issues a connection handle that is used to identify the connection in subsequent function calls.

Note: A program can have connections to more than one queue manager if the platform supports multiple queue managers running on it. \triangle

- 2 Opens the desired queue. When opening a queue, the program must define how it intends to use it. For example, the program can send (put) messages to the queue, receive (get) messages from the queue, or it can do both. If a queue is opened by using the INQUIRE option, then the queue can be queried for information about the queue itself. Similarly, if the queue is opened using the SET option, then various queue attributes can be set. If the queue is opened successfully, then the queue manager issues an object handle that is used to identify the queue in subsequent function calls.
- 3 (Optional) Puts messages on the queue by using the SAS CALL routine MQPUT. The queue is identified using the connection handle for the queue manager and the object handle for the queue. In addition, several other functions are available for creating and manipulating the data in the message as well as setting options that help the receiving program locate the message in the queue.
- 4 (Optional) Opens the same queue (or a different one) for retrieving messages. The program uses the MQGET routine specifying the connection handle to the queue manager and the object handle for the queue from which it wants to retrieve the message. There are a number of options that can be set to help identify the message to get from the queue.
- 5 (Optional) Releases the resources allocated by a SAS internal handle. These resources are associated with message options and descriptors.

Interface Models

WebSphere MQ provides two Message Queue Interface (MQI) models:

Base/Server model

runs on the same machine as the WebSphere MQ Base product and WebSphere MQ Server

Client model

runs on a different machine from the WebSphere MQ Base product and WebSphere MQ Server

IBM requires programs to be linked with different libraries according to the model that will be used. The default model that is assumed by SAS is the *Base/Server* model. If you do not want the default model, then you must specify the MQMODEL SAS macro variable and set it to a value of CLIENT:

```
%let MQMODEL=CLIENT;
```

You must set this variable before calling any WebSphere MQ interface function.

If the program is using the client model, then it opens a remote queue manager. WebSphere MQ clients always connect across a network. For information about configuring remote access, see “Configuring WebSphere MQ Client Access” on page 11.

Data Conversion

Overview of Data Conversion

If you will be putting or getting messages from heterogeneous systems, then data conversion must be considered. Data conversion is usually categorized as follows:

- Character data conversion
- Numeric data conversion

The Coded Character Set ID (CCSID) or code page is a number that represents a character translation table to be used between two distinct systems. *Encoding* is the term generally used to represent how numeric data is represented on a particular system. WebSphere MQ channel communication (Transmission Segment Header and Message Descriptor) data are converted internally by WebSphere MQ; however, the user portion of a message is not. It is the responsibility of the program to convert this data.

Data conversion of this user portion can be handled by either WebSphere MQ conversion exit routines or by SAS.

Converting Data within WebSphere MQ

For WebSphere MQ to perform the data conversion of the user portion of a message, you must perform the following steps:

- 1 When putting (MQPUT) a message on a queue, specify the FORMAT (conversion exit) that the receiver should use to convert the incoming message.
- 2 Convert a message:
 - WebSphere MQ provides an internal conversion format, MQSTR, that can be used to convert a message comprised entirely of character data.
 - If the message is not comprised entirely of character data, then you must create a conversion exit.
- 3 The receiving (MQGET) program must tell WebSphere MQ to do the required data conversion based on the incoming message format and data encoding. The program does this by specifying the CONVERT option on the Get Message Options, which is part of the MQGET call. If you do not want to set up static conversion exit routines, then you can let SAS convert the data for you as an alternative solution.

For more information about conversion within WebSphere MQ, see the WebSphere MQ documentation at www.ibm.com.

Converting Data in SAS

By default, if you do not specify the CONVERT Get Message Option, then SAS converts the data conversion to the default encoding for the SAS session. To disable the automatic SAS data conversion, specify the MQSASCNV SAS macro variable and set it to a value of DISABLE or OFF:

```
%let MQSASCNV=OFF
```

You can use the KCVT function to convert your data manually. Converting data manually is especially useful for programs that put reply messages on a queue.

For example, your SAS program might use messaging to interact with a Java Web application that uses UTF-8 encoding. When receiving messages, SAS automatically converts the message data to the session encoding. However, you must convert the data back to UTF-8 before sending it to the reply queue. The following code converts the variable TEXT from WLatin1 to UTF-8:

```
text= kcvf(text, wlatin1, utf8);
```

For more information, see "KCVT Function" in the *SAS National Language Support (NLS): Reference Guide*.

WebSphere MQ Coding Examples

Introduction to the WebSphere MQ Examples

This section contains examples of using the WebSphere MQ interface to send and receive messages to and from application messaging queues.

Please note the following points about freeing resources used in conjunction with the WebSphere MQ Interface:

- When a SAS DATA step ends, all resources consumed by this DATA step are automatically freed. That is, all internal SAS handles are automatically freed, as well as being disconnected from all queue managers that were connected during this DATA step execution. However, it is good programming practice to free these resources using the functions provided.
- When using the SAS Macro Language to interface with WebSphere MQ, ensure that all resources are freed programmatically. Unlike the DATA step, resources consumed by the SAS Macro Language are never implicitly freed during SAS execution.

DATA Step Coding Example: Put a Message on a Queue

This example puts a message on a queue.

```
data _null_;
  length hconn hobj cc reason 8;
  length rc hod hpmo hmd hmap hdata 8;
  length parms $ 200 options $ 200 action $ 3 msg $ 200;

  hconn=0;
```

```

hobj=0;
hod=0;
hpmo=0;
hmd=0;
hmap=0;
hdata=0;

put '----- Connect to QMgr -----';
qmgr="TEST";
call mqconn(qmgr, hconn, cc, reason);
if cc ^= 0 then do;
  if reason = 2002 then do;
    put 'Already connected to QMgr ' qmgr;
  end;
else do;
  if reason = 2059 then
    put 'MQCONN: QMgr not available...
needs to be started';
  else
    put 'MQCONN: failed with reason= ' reason;
    goto exit;
  end;
end;
else put 'MQCONN: successfully connected to QMgr ' qmgr;

put '----- Generate object descriptor -----';
action="GEN";
parms="OBJECTNAME";
objname="TEST";
call mqod(hod, action, rc, parms, objname);
if rc ^= 0 then do;
  put 'MQOD: failed with rc= ' rc;
  msg = sysmsg();
  put msg;
  goto exit;
end;
else put 'MQOD: successfully generated
object descriptor';

put '----- Open queue object for output -----';
options="OUTPUT";
call mqopen(hconn, hod, options, hobj, cc, reason);
if cc ^= 0 then do;
  put 'MQOPEN: failed with reason= ' reason;
  goto exit;
end;
else put 'MQOPEN: successfully opened queue for output';

put '----- Generate put message options -----';
call mqpmo(hpmo, action, rc);
if rc ^= 0 then do;

```

```

        put 'MQPMO: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
else put 'MQPMO: successfully generated put
        message options';

    put '----- Generate message descriptor -----';
    parms="PERSISTENCE";
    persist="PERSISTENT"; /* persistent message */
    call mqmd(hmd, action, rc, parms, persist);
    if rc ^= 0 then do;
        put 'MQMD: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
else put 'MQMD: successfully generated
        message descriptor';

    put '----- Generate map descriptor -----';
    /* data will not be aligned */
    desc1="SHORT";
    desc2="LONG";
    desc3="DOUBLE";
    desc4="CHAR,,50"; /* blank pad to 50 bytes */
    call mqmap(hmap, rc, desc1, desc2, desc3, desc4);
    if rc ^= 0 then do;
        put 'MQMAP: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
else put 'MQMAP: successfully generated map descriptor';

    put '--- Generate data descriptor - actual data ----';
    parm1=100;
    parm2=9999;
    parm3=9999.9999;
    parm4="This is a test.";
    call mqsetparms(hdata, hmap, rc, parm1,
        parm2, parm3, parm4);
    if rc ^= 0 then do;
        put 'MQSETPARMS: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
else put 'MQSETPARMS: successfully generated
        data descriptor';

```

```

put '----- Put message on queue -----';
call mqput(hconn, hobj, hmd, hpmo, hdata, cc, reason);
if cc ^= 0 then do;
    put 'MQPUT: failed with reason= ' reason;
    goto exit;
end;
else do;
    put 'MQPUT: successfully put message on queue';

    /* inquire about message descriptor
       output parameters */
    action="INQ";
    parms="MSGID,PUTAPPLTYPE,PUTAPPLNAME,
          PUTDATE,PUTTIME";

    length msgid $ 48 applname $ 28 date $ 8 time $ 8;
    call mqmd(hmd, action, rc, parms, msgid, appltype,
              applname, date, time);
    if rc ^= 0 then do;
        put 'MQMD: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
    end;
    else do;
        put 'Message descriptor output parameters are: ';
        put 'MSGID= ' msgid;
        put 'PUTAPPLTYPE= ' appltype;
        put 'PUTAPPLNAME= ' applname;
        put 'PUTDATE= ' date;
        put 'PUTTIME= ' time;
    end;
end;

exit:
if hobj ^= 0 then do;
    put '----- Close queue -----';
    options="NONE";
    call mqclose(hconn, hobj, options, cc, reason);
    if cc ^= 0 then do;
        put 'MQCLOSE: failed with reason= ' reason;
    end;
    else put 'MQCLOSE: successfully closed queue';
end;

if hconn ^= 0 then do;
    put '----- Disconnect from QMgr -----';
    call mqdisc(hconn, cc, reason);
    if cc ^= 0 then do;
        put 'MQDISC: failed with reason= ' reason;
    end;
end;

```

```

        else put 'MQDISC: successfully disconnected
              from QMgr';
end;

if hod ^= 0 then do;
    call mqfree(hod);
    put 'Object descriptor handle freed';
end;
if hpmo ^= 0 then do;
    call mqfree(hpmo);
    put 'Put message options handle freed';
end;
if hmd ^= 0 then do;
    call mqfree(hmd);
    put 'Message descriptor handle freed';
end;
if hmap ^= 0 then do;
    call mqfree(hmap);
    put 'Map descriptor handle freed';
end;
if hdata ^= 0 then do;
    call mqfree(hdata);
    put 'Data descriptor handle freed';
end;

run;

```

DATA Step Coding Example: Retrieve a Message

This example retrieves a message from a queue.

```

data _null_;
length hconn hobj cc reason 8;
length rc hod hgmo hmd hmap msglen 8;
length parms $ 200 options $ 200 action $ 3 msg $ 200;

hconn=0;
hobj=0;
hod=0;
hgmo=0;
hmd=0;
hmap=0;

put '----- Connect to QMgr -----';
qmgr="TEST";
call mqconn(qmgr, hconn, cc, reason);
if cc ^= 0 then do;
    if reason = 2002 then do;
        put 'Already connected to QMgr ' qmgr;
    end;
else do;
    if reason = 2059 then

```

```

        put 'MQCONN: QMgr not available...
            needs to be started';
    else
        put 'MQCONN: failed with reason= ' reason;
        goto exit;
    end;
end;
else put 'MQCONN: successfully connected to QMgr ' qmgr;

put '----- Generate object descriptor -----';
action="GEN";
parms="OBJECTNAME";
objname="TEST";
call mqod(hod, action, rc, parms, objname);
if rc ^= 0 then do;
    put 'MQOD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;
else put 'MQOD: successfully generated
    object descriptor';

put '----- Open queue object for input -----';
options="INPUT_SHARED";
call mqopen(hconn, hod, options, hobj, cc, reason);
if cc ^= 0 then do;
    put 'MQOPEN: failed with reason= ' reason;
    goto exit;
end;
else put 'MQOPEN: successfully opened queue for output';

put '----- Generate get message options -----';
call mqgmo(hgmo, action, rc);
if rc ^= 0 then do;
    put 'MQGMO: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;
else put 'MQGMO: successfully generated get
    message options';

put '----- Generate message descriptor -----';
call mqmd(hmd, action, rc);
if rc ^= 0 then do;
    put 'MQMD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

```

```

end;
else put 'MQMD: successfully generated
        message descriptor';

put '----- Generate map descriptor -----';
desc1="SHORT";
desc2="LONG";
desc3="DOUBLE";
desc4="CHAR,,50";
call mqmap(hmap, rc, desc1, desc2, desc3, desc4);
if rc ^= 0 then do;
    put 'MQMAP: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;
else put 'MQMAP: successfully generated map descriptor';

put '----- Get message from queue -----';
call mqget(hconn, hobj, hmd, hgmo, msglen, cc, reason);
if cc ^= 0 then do;
    if reason = 2033 then put 'No message available';
    else put 'MQGET: failed with reason= ' reason;
    goto exit;
end;
else do;
    put 'MQGET: successfully retrieved message
        from queue';
    put 'message length= ' msglen;

    /* inquire about message descriptor
       output parameters */
    action="INQ";
    parms="REPORT,MSGTYPE,FEEDBACK,MSGID,
          CORRELID,USERIDENTIFIER,PUTAPPLTYPE,
          PUTAPPLNAME,PUTDATE,PUTTIME";

    length report $ 30 msgtype 8 feedback 8 msgid $ 48
          correlid $ 48 userid $ 12 appltype 8
          applname $ 28 date $ 8 time $8;

    call mqmd(hmd, action, rc, parms, report,
              msgtype, feedback, msgid, correlid, userid,
              appltype, applname, date, time);
    if rc ^= 0 then do;
        put 'MQMD: failed with rc ' rc;
        msg = sysmsg();
        put msg;
    end;
    else do;
        put 'Message descriptor output parameters are: ';
        put 'REPORT= ' report;

```

```

    put 'MSGTYPE= ' msgtype;
    put 'FEEDBACK= ' feedback;
    put 'MSGID= ' msgid;
    put 'CORRELID= ' correlid;
    put 'USERIDENTIFIER= ' userid;
    put 'PUTAPPLTYPE= ' appltype;
    put 'PUTAPPLNAME= ' applname;
    put 'PUTDATE= ' date;
    put 'PUTTIME= ' time;
  end;
end;

if msglen > 0 then do;
  /* retrieve SAS variables from GET buffer */
  length parm1 parm2 parm3 8 parm4 $ 50;

  call mqgetparms(hmap, rc, parm1,
    parm2, parm3, parm4);
  put 'Display SAS variables: ';
  put 'parm1= ' parm1;
  put 'parm2= ' parm2;
  put 'parm3= ' parm3;
  put 'parm4= ' parm4;
  if rc ^= 0 then do;
    put 'MQGETPARMS: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
  end;
end;
else put 'No data associated with message';

exit:
if hobj ^= 0 then do;
  put '----- Close queue -----';
  options="NONE";
  call mqclose(hconn, hobj, options, cc, reason);
  if cc ^= 0 then do;
    put 'MQCLOSE: failed with reason= ' reason;
  end;
  else put 'MQCLOSE: successfully closed queue';
end;

if hconn ^= 0 then do;
  put '----- Disconnect from QMgr -----';
  call mqdisc(hconn, cc, reason);
  if cc ^= 0 then do;
    put 'MQDISC: failed with reason= ' reason;
  end;
  else put 'MQDISC: successfully disconnected
    from QMgr';
end;

```

```

if hod ^= 0 then do;
    call mqfree(hod);
    put 'Object descriptor handle freed';
end;
if hgmo ^= 0 then do;
    call mqfree(hgmo);
    put 'Get message options handle freed';
end;
if hmd ^= 0 then do;
    call mqfree(hmd);
    put 'Message descriptor handle freed';
end;
if hmap ^= 0 then do;
    call mqfree(hmap);
    put 'Map descriptor handle freed';
end;

run;

```

Processing a Text File

This example puts a text file to a queue.

```

/** bits within md.msgflags */
%let segment_allow=1;
%let segment=2;
%let last_segment=4;
%let group=8;
%let last_group=16;

data _null_;
length rc 8;
length msg $ 200;
length hconn hod hpmo hobj hmd hmap hdata 8;
length cc reason 8;
length record $ 256;
length msgflags 8;

/* send this file to the queue */
infile 'd:\test.txt' length=reclen end=eof;

call mqconn("TESTQMGR", hconn, cc, reason);
if cc ^= 0 then do;
    if reason = 2002 then do;
        put 'Already connected to QMgr';
    end;
else do;
    if reason = 2059 then
        put 'MQCONN: QMgr not available...
            needs to be started';
    else

```

```

        put 'MQCONN: failed with reason= ' reason;
        goto exit;
    end;
end;

put '----- Generate object descriptor -----';
call mqod(hod, "GEN", rc, "OBJECTNAME", "TESTQ");
if rc ^= 0 then do;
    put 'MQOD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Open queue object for output -----';
call mqopen(hconn, hod, "OUTPUT", hobj, cc, reason);
if cc ^= 0 then do;
    put 'MQOPEN: failed with reason= ' reason;
    goto exit;
end;

put '----- Generate put message options -----';
/** QMgr will generate a unique msgid on every put as **/
/** well as generate a groupid for all of the msgs    **/
/** and incrementally keep up with the sequencing... **/
call mqpmo(hpmo, "GEN", rc, "OPTIONS",
    "NEW_MSGID,LOGICAL_ORDER");
if rc ^= 0 then do;
    put 'MQPMO: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Generate message descriptor -----';
/** specify the message belongs to a group **/
msgflags=&group;
call mqmd(hmd, "GEN", rc, "PERSISTENCE,MSGTYPE,MSGFLAGS",
    "PERSISTENT", 10000, msgflags);
if rc ^= 0 then do;
    put 'MQMD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Generate map descriptor -----';
/* longest record in file is 255 bytes+1 length byte... */
/* therefore all messages on the queue pertaining to    */
/* this file will be blank-padded for 256 bytes...      */
call mqmap(hmap, rc, "char,,256");
if rc ^= 0 then do;
    put 'MQMAP: failed';
    msg = sysmsg();

```

```

    put msg;
    goto exit;
end;

do until(eof);
    input @;
    input record $varying256. reclen;

    call mqsetparms(hdata, hmap, rc, record);
    if( rc ) then do;
        put 'MQSETPARMS: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    /** set last in group if eof **/
    if( eof ) then do;
        msgflags + &last;_group;
        call mqmd(hmd, "SET", rc, "MSGFLAGS", msgflags);
        if rc ^= 0 then do;
            put 'MQMD: failed with rc= ' rc;
            msg = sysmsg();
            put msg;
            goto exit;
        end;
    end;

    put '--- Put msg on queue ----';
    call mqput(hconn, hobj, hmd, hpmo, hdata,
        cc, reason);
    if cc ^= 0 then do;
        put 'MQPUT: failed with reason= ' reason;
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    /** free data */
    call mqfree(hdata);
end;

exit:
if( hobj ) then do;
    call mqclose(hconn, hobj, "NONE", cc, reason);
    if( cc ) then do;
        put 'MQCLOSE: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
    end;
end;

if( hconn ) then do;

```

```

    call mqdisc(hconn, cc, reason);
    if( cc ) then do;
        put 'MQDISC: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
    end;
end;

if hod ^= 0 then do;
    call mqfree(hod);
    put 'Object descriptor handle freed';
end;
if hpmo ^= 0 then do;
    call mqfree(hpmo);
    put 'Put message options handle freed';
end;
if hmd ^= 0 then do;
    call mqfree(hmd);
    put 'Message descriptor handle freed';
end;
if hmap ^= 0 then do;
    call mqfree(hmap);
    put 'Map descriptor handle freed';
end;

stop;

run;

```

Getting a Text File From a Queue

This example gets a text file from a queue.

```

/* Get first text file on a queue... ie. msgtype=100000 */

/* This example opens queue with a browse cursor and */
/* browses the first msg in every group looking for */
/* a msg with msgtype=100000... once it is found, */
/* open a fetch instance to remove all msgs in that */
/* particular group... */

/* if you knew upfront the groupid that you wanted, you */
/* could just open a single instance of the queue and */
/* remove the group in logical order without having to */
/* do any initial browsing... */

/* bit test macros */
%let segment_allow_mask='.....1'b;
%let segment_mask='.....1'b;
%let last_segment_mask='.....1..'b;
%let group_mask='....1...'b;
%let last_group_mask='...1....'b;

filename output 'd:\testdup.txt';

```

```

data _null_;
length rc 8;
length msg $ 200;
length cc reason 8;
length hconn hod hgmo hobj hmap 8;
length record $ 256;
length msgtype seqno msgflags 8;
length groupid $ 48;

fileid = fopen('output', 'o', 256, 'v');
if( fileid = 0 ) then do;
    put 'Error opening output file...';
    goto exit;
end;

put '----- Connect to QMgr -----';
call mqconn("TESTQMGR", hconn, cc, reason);
if cc ^= 0 then do;
    if reason = 2002 then do;
        put 'Already connected to QMgr';
    end;
    else do;
        if reason = 2059 then
            put 'MQCONN: QMgr not available... needs to
                be started';
        else
            put 'MQCONN: failed with reason= ' reason;
            goto exit;
        end;
    end;
end;

put '----- Generate object descriptor -----';
call mqod(hod, "GEN", rc, "OBJECTNAME", "TESTQ");
if rc ^= 0 then do;
    put 'MQOD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Open queue object for input -----';
call mqopen(hconn, hod, "INPUT_SHARED,BROWSE", hobj,
    cc, reason);
if cc ^= 0 then do;
    put 'MQOPEN: failed with reason= ' reason;
    goto exit;
end;

put '----- Generate get message options -----';
call mqgmo(hgmo, "GEN", rc, "options, matchoptions",

```

```

    "browse_next", "seqnumber");
if rc ^= 0 then do;
    put 'MQGMO: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Generate message descriptor -----';
/** browse first msg in group only **/
call mqmd(hmd, "GEN", rc, "msgseqnumber", 1);
if rc ^= 0 then do;
    put 'MQMD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

recv:
call mqget(hconn, hobj, hmd, hgmo, msglen, cc, reason);
if( cc ) then do;
    if( reason = 2033 ) then do;
        put 'reached end of queue';
        goto exit;
    end;
    else do;
        put 'MQGET: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
end;

/* inquire about msg properties */
call mqmd(hmd, "INQ", rc,
    "MSGTYPE,GROUPID,MSGSEQNUMBER,MSGFLAGS",
    msgtype, groupid, seqno, msgflags);
if( rc ) then do;
    put 'MQMD failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

put msgtype=;
put groupid=;
put seqno=;
put msgflags=;

if( msgtype = 100000 ) then do;
    /* file processing... */

```

```

put '----- Generate map descriptor -----';
/* all file messages were sent to the queue as
   256 bytes blank-padded */
call mqmap(hmap, rc, "char,,256");
if( rc ) then do;
  put 'MQMAP: failed';
  msg = sysmsg();
  put msg;
  goto exit;
end;

/* close browse instance */
call mqclose(hconn, hobj, "NONE", cc, reason);
if( cc ) then do;
  put 'MQCLOSE: failed with reason = ' reason;
  msg = sysmsg();
  put msg;
end;

/* open queue in fetch mode */
hobj=0;
call mqopen(hconn, hod, "INPUT_SHARED", hobj,
  cc, reason);
if cc ^= 0 then do;
  put 'MQOPEN: failed with reason= ' reason;
  goto exit;
end;

call mqgmo(hgmo, "SET", rc, "options, matchoptions",
  "logical_order,complete_msg,all_msgs_available",
  "groupid");
if rc ^= 0 then do;
  put 'MQGMO: failed with rc= ' rc;
  msg = sysmsg();
  put msg;
  goto exit;
end;

call mqmd(hmd, "SET", rc, "groupid", groupid);
if rc ^= 0 then do;
  put 'MQMD: failed with rc= ' rc;
  msg = sysmsg();
  put msg;
  goto exit;
end;

next:
call mqget(hconn, hobj, hmd, hgmo, msglen,
  cc, reason);
if( cc ) then do;
  put 'MQGET: failed with reason = ' reason;
  msg = sysmsg();
  put msg;

```

```

        goto exit;
    end;

    /* inquire about msg properties */
    call mqmd(hmd, "INQ", rc,
        "MSGTYPE,GROUPID,MSGSEQNUMBER,MSGFLAGS",
        msgtype, groupid, seqno, msgflags);
    if( rc ) then do;
        put 'MQMD failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    put msgtype=;
    put groupid=;
    put seqno=;
    put msgflags=;

    /* retrieve record from internal buffer */
    call mqgetparms(hmap, rc, record);
    if( rc ) then do;
        put 'MQGETPARMS: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    put 'write record to file';
    rc = fput(fileid, record);
    if( rc ) then do;
        put 'Error writing to output file buffer...';
        goto exit;
    end;

    /* flush it to disk */
    rc = fwrite(fileid);
    if( rc ) then do;
        put 'Error writing to output file...';
        goto exit;
    end;

    /** receive until last in group **/
    if( (msgflags=&group;_mask) AND
        (NOT(msgflags=&last;_group_mask)) )
        then goto next;
    else goto exit;

end;
else goto recv;

exit:
if( hobj ) then do;

```

```

        call mqclose(hconn, hobj, "NONE", cc, reason);
    if( cc ) then do;
        put 'MQCLOSE: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
    end;
end;

if( hconn ) then do;
    call mqdisc(hconn, cc, reason);
    if( cc ) then do;
        put 'MQDISC: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
    end;
end;

if( hod ) then
    call mqfree(hod);
if( hgmo ) then
    call mqfree(hgmo);
if( hmd ) then
    call mqfree(hmd);
if( hmap ) then
    call mqfree(hmap);

/* close file */
rc = fclose(fileid);
if( rc ) then put 'Error closing output file';

run;

```

Processing a Binary File

This example puts a binary file on a queue.

```

data _null_;
length rc 8;
length msg $ 200;
length hconn hod hpmo hobj hmd hmap hdata 8;
length cc reason 8;
length corrid $ 48;
length msgbuf $ 256;
length seqno 8 seqstr $ 4;

/* send this file to the queue */
infile 'd:\test.exe' recfm=f lrecl=1 end=eof;

call mqconn("TESTQMGR", hconn, cc, reason);
if cc ^= 0 then do;
    if reason = 2002 then do;
        put 'Already connected to QMgr';
    end;
else do;

```

```

        if reason = 2059 then
            put 'MQCONN: QMgr not available... needs to
              be started';
        else
            put 'MQCONN: failed with reason= ' reason;
            goto exit;
        end;
    end;
end;

put '----- Generate object descriptor -----';
call mqod(hod, "GEN", rc, "OBJECTNAME", "TESTQ");
if rc ^= 0 then do;
    put 'MQOD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Open queue object for output -----';
call mqopen(hconn, hod, "OUTPUT", hobj, cc, reason);
if cc ^= 0 then do;
    put 'MQOPEN: failed with reason= ' reason;
    goto exit;
end;

put '----- Generate put message options -----';
call mqpmo(hpmo, "GEN", rc);
if rc ^= 0 then do;
    put 'MQPMO: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Generate message descriptor -----';
call mqmd(hmd, "GEN", rc, "PERSISTENCE,MSGTYPE",
  "PERSISTENT", 10001);
if rc ^= 0 then do;
    put 'MQMD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Generate map descriptor -----';
/* send 256 byte messages to the queue */
call mqmap(hmap, rc, "char,,256");
if rc ^= 0 then do;
    put 'MQMAP: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

```

```

/* all of these messages will have the same
   correlationid+seqno */
corrid="42696e46696c65212121"; /* BinFile!!! */

seqno = 0;

i=1;
do until(eof);
  /* read a byte at a time */
  input x $char1.;
  i+1;
  substr(msgbuf,i,1) = x;
  if( i = 256 or eof ) then do;
    /* set length of this record embedded
       as first byte of message */
    substr(msgbuf,1,1) = put(i-1,pib1.);

    call mqsetparms(hdata, hmap, rc, msgbuf);
    if( rc ) then do;
      put 'MQSETPARMS: failed';
      msg = sysmsg();
      put msg;
      goto exit;
    end;

    /* add sequence # to correlationid */
    seqstr = put(seqno, hex4.);
    substr(corrid,21,4) = seqstr;
    seqno+1;

    /* set correlation id and let MQ generate
       msgid for this message */
    call mqmd(hmd, "SET", rc, "CORRELID,MSGID",
             corrid, "");
    if rc ^= 0 then do;
      put 'MQMD: failed with rc= ' rc;
      msg = sysmsg();
      put msg;
      goto exit;
    end;

    put '--- Put msg on queue ----';
    call mqput(hconn, hobj, hmd, hpmo, hdata,
              cc, reason);
    if cc ^= 0 then do;
      put 'MQPUT: failed with reason= ' reason;
      msg = sysmsg();
      put msg;
      goto exit;
    end;

    /* free data */
    call mqfree(hdata);

```

```

        /* reset message buffer entities */
        i=1;
        msgbuf="";
    end;
end;

exit:
if( hobj ) then do;
    call mqclose(hconn, hobj, "NONE", cc, reason);
    if( cc ) then do;
        put 'MQCLOSE: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
    end;
end;

if( hconn ) then do;
    call mqdisc(hconn, cc, reason);
    if( cc ) then do;
        put 'MQDISC: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
    end;
end;

if hod ^= 0 then do;
    call mqfree(hod);
    put 'Object descriptor handle freed';
end;
if hpmo ^= 0 then do;
    call mqfree(hpmo);
    put 'Put message options handle freed';
end;
if hmd ^= 0 then do;
    call mqfree(hmd);
    put 'Message descriptor handle freed';
end;
if hmap ^= 0 then do;
    call mqfree(hmap);
    put 'Map descriptor handle freed';
end;

stop;

run;

```

Getting a Binary File from a Queue

This example gets the first binary file on a queue.

```

filename output 'd:\testdup.exe';

data _null_;

```

```

length rc 8;
length msg $ 200;
length cc reason 8;
length hconn hod hgmo hobj hobj2 hmap 8;
length corrid filecorrid $ 48;
length msgbuf stream $ 256;
length len 8;
length seqno 8;

fileid = fopen('output', 'o', 0, 'b');
if( fileid = 0 ) then do;
    put 'Error opening output file...';
    goto exit;
end;

put '----- Connect to QMgr -----';
call mqconn("TESTQMGR", hconn, cc, reason);
if cc ^= 0 then do;
    if reason = 2002 then do;
        put 'Already connected to QMgr';
    end;
    else do;
        if reason = 2059 then
            put 'MQCONN: QMgr not available... needs to be
                started';
        else
            put 'MQCONN: failed with reason= ' reason;
            goto exit;
        end;
    end;
end;

put '----- Generate object descriptor -----';
call mqod(hod, "GEN", rc, "OBJECTNAME", "TESTQ");
if rc ^= 0 then do;
    put 'MQOD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Open queue object for input -----';
call mqopen(hconn, hod, "INPUT_SHARED,BROWSE", hobj, cc,
    reason);
if cc ^= 0 then do;
    put 'MQOPEN: failed with reason= ' reason;
    goto exit;
end;

put '----- Generate get message options -----';
call mqgmo(hgmo, "GEN", rc, "options", "browse_next");

```

```

if rc ^= 0 then do;
    put 'MQGMO: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Generate message descriptor -----';
call mqmd(hmd, "GEN", rc);
if rc ^= 0 then do;
    put 'MQMD: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

seqno=0;

recv:
call mqget(hconn, hobj, hmd, hgmo, msglen, cc, reason);
if( cc ) then do;
    if( reason = 2033 ) then do;
        put 'reached end of queue';
        goto exit;
    end;
    else do;
        put 'MQGET: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
end;

/* inquire about msg properties */
call mqmd(hmd, "INQ", rc, "CORRELID,MSGTYPE",
    corrid, msgtype);
if( rc ) then do;
    put 'MQMD failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

/* default for getting next msg on queue */
call mqgmo(hgmo, "SET", rc, "options", "browse_next");
if rc ^= 0 then do;
    put 'MQGMO: failed with rc= ' rc;
    msg = sysmsg();
    put msg;
    goto exit;
end;

```

```

if( msgtype = 100001 ) then do;
  /* file processing... */
  outofseq=0;

  if( filecorrid = "" ) then do;
    /* file begins at this message */

    /* write all correlating messages to this file */
    filecorrid = substr(corrid,1,20);

    put '----- Generate map descriptor -----';
    /* all file messages were sent to the queue as 256
       bytes blank-padded */
    call mqmap(hmap, rc, "char,,256");
    if( rc ) then do;
      put 'MQMAP: failed';
      msg = sysmsg();
      put msg;
      goto exit;
    end;
  end;

  /* make sure message belongs to this file */
  if( substr(corrid,1,20) = filecorrid ) then do;
    if( seqno ^= input(substr(corrid,21,4), hex4.) )
      then do;
      /* this message is out of sequence so
         search for it */
      outofseq=1;

      /* open another instance to search for
         out-of-seq message */
      call mqopen(hconn, hod, "INPUT_SHARED,BROWSE",
        hobj2, cc, reason);
      if cc ^= 0 then do;
        put 'MQOPEN: failed with reason= ' reason;
        goto exit;
      end;

      corrid = filecorrid;
      substr(corrid,21,4) = put(seqno, hex4.);
      call mqmd(hmd, "SET", rc, "MSGID,CORRELID",
        "", corrid);
      if( rc ) then do;
        put 'MQMD: failed';
        msg = sysmsg();
        put msg;
      end;

      call mqgmo(hgmo, "SET", rc, "OPTIONS",
        "BROWSE_FIRST");
      if( rc ) then do;
        put 'MQGMO: failed';
        msg = sysmsg();

```

```

        put msg;
        goto exit;
    end;

    call mqget(hconn, hobj2, hmd, hgmo, msglen,
              cc, reason);
    if( cc ) then do;
        if( reason = 2033 ) then do;
            put 'Error: reached end of queue while
              searching for out-of-sequence msg';
            goto exit;
        end;
        else do;
            put 'MQGET: failed with reason = ' reason;
            msg = sysmsg();
            put msg;
            goto exit;
        end;
    end;
end;

/* increment sequence number for
   next expected message */
seqno+1;

/* retrieve record from internal buffer */
call mqgetparms(hmap, rc, msgbuf);
if( rc ) then do;
    put 'MQGETPARMS: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

/* length of this stream is embedded
   as 1st byte in msg */
len = input(substr(msgbuf,1,1), pib1.);
stream = substr(msgbuf,2);

put 'write stream to file';
rc = fput(fileid, substr(stream,1,len));
if( rc ) then do;
    put 'Error writing to output file buffer...';
    goto exit;
end;

/* flush it to disk */
rc = fwrite(fileid);
if( rc ) then do;
    put 'Error writing to output file...';
    goto exit;
end;

```

```

    /* now remove it from the queue... */
    call mqgmo(hgmo, "SET", rc, "OPTIONS",
"MSG_UNDER_CURSOR");
    if( rc ) then do;
        put 'MQGMO: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    if( outofseq ) then do;
        call mqget(hconn, hobj2, hmd, hgmo, msglen,
            cc, reason);
        if( cc ) then do;
            put 'problems removing message from queue';
            msg = sysmsg();
            put msg;
            goto exit;
        end;

        /* close queue */
        call mqclose(hconn, hobj2, "NONE", cc, reason);

        /* re-read previous message */
        call mqgmo(hgmo, "SET", rc, "OPTIONS",
            "BROWSE_MSG_UNDER_CURSOR");
        if( rc ) then do;
            put 'MQGMO: failed';
            msg = sysmsg();
            put msg;
            goto exit;
        end;
    end;
else do;
    call mqget(hconn, hobj, hmd, hgmo, msglen,
        cc, reason);
    if( cc ) then do;
        put 'problems removing message from queue';
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    /* browse next message */
    call mqgmo(hgmo, "SET", rc, "OPTIONS",
        "BROWSE_NEXT");
    if( rc ) then do;
        put 'MQGMO: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;
end;
end;
end;

```

```

end;

/* finish retrieving all messages belonging
to this file */

/* reset message descriptor */
call mqmd(hmd, "SET", rc, "MSGID,CORRELID", "", "");
if( rc ) then do;
    put 'MQMD: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

goto recv;

exit:
if( hobj ) then do;
    call mqclose(hconn, hobj, "NONE", cc, reason);
    if( cc ) then do;
        put 'MQCLOSE: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
    end;
end;

if( hconn ) then do;
    call mqdisc(hconn, cc, reason);
    if( cc ) then do;
        put 'MQDISC: failed with reason = ' reason;
        msg = sysmsg();
        put msg;
    end;
end;

if( hod ) then
    call mqfree(hod);
if( hgmo ) then
    call mqfree(hgmo);
if( hmd ) then
    call mqfree(hmd);
if( hmap ) then
    call mqfree(hmap);

/* close file */
rc = fclose(fileid);
if( rc ) then put 'Error closing output file';

run;

```

Macro Language Coding Examples

This section shows examples of using the SAS Macro Language to make calls to the MQSeries Interface.

```

%macro putmsg;
%let hconn=0;
%let hobj=0;
%let hod=0;
%let hpmo=0;
%let hmd=0;
%let hmap=0;
%let hdata=0;
%put ----- Connect to QMgr -----;
%let qmgr=TEST;
%let cc=0;
%let reason=0;
%syscall mqconn(qmgr, hconn, cc, reason);
%if &cc; ^= 0 %then %do;
    %if &reason; = 2002 %then %do;
        %put Already connected to QMgr &qmgr;
    %end;
    %else %do;
        %if &reason; = 2059 %then
            %put MQCONN: QMgr not available...
                needs to be started;
        %else
            %put MQCONN: failed with reason= &reason;
            %goto exit;
        %end;
    %end;

%put ----- Generate object descriptor -----;
%let action=GEN;
%let rc=0;
%let parms=OBJECTNAME;
%let objname=TEST;
%syscall mqod(hod, action, rc, parms, objname);
%if &rc; ^= 0 %then %do;
    %put MQOD: failed with rc= &rc;
    %put %sysfunc(sysmsg());
    %goto exit;
%end;
%else %put MQOD: successfully generated
    object descriptor;

%put ----- Open queue object for output -----;
%let options=OUTPUT;
%syscall mqopen(hconn, hod, options, hobj, cc, reason);
%if &cc; ^= 0 %then %do;
    %put MQOPEN: failed with Reason= &reason;
    %goto exit;
%end;
%else %put MQOPEN: successfully opened queue for output;

%put ----- Generate put message options -----;

```

```

%syscall mqpmo(hpmo, action, rc);
%if &rc; ^= 0 %then %do;
    %put MQPMO: failed with rc= &rc;
    %put %sysfunc(sysmsg());
    %goto exit;
%end;
%else %put MQPMO: successfully generated put
    message options;

%put ----- Generate message descriptor -----;
%let parms=PERSISTENCE;
%let persist=PERSISTENT;
%syscall mqmd(hmd, action, rc, parms, persist);
%if &rc; ^= 0 %then %do;
    %put MQMD: failed with rc= &rc;
    %put %sysfunc(sysmsg());
    %goto exit;
%end;
%else %put MQMD: successfully generated
    message descriptor;

%put ----- Generate map descriptor -----;
/* data will not be aligned */
%let desc1=SHORT;
%let desc2=LONG;
%let desc3=DOUBLE;
%let desc4=CHAR,,50;
%syscall mqmap(hmap, rc, desc1, desc2, desc3, desc4);
%if &rc; ^= 0 %then %do;
    %put MQMAP: failed with rc= &rc;
    %put %sysfunc(sysmsg());
    %goto exit;
%end;
%else %put MQMAP: successfully generated map descriptor;

%put --- Generate data descriptor - actual data ----;
%let parm1=100;
%let parm2=9999;
%let parm3=9999.999;
%let parm4=This is a test.;
%syscall mqsetparms(hdata, hmap, rc, parm1,
    parm2, parm3, parm4);
%if &rc; ^= 0 %then %do;
    %put MQSETPARMS: failed with rc= &rc;
    %put %sysfunc(sysmsg());
    %goto exit;
%end;
%else %put MQSETPARMS: successfully generated
    data descriptor;

```

```

%put ----- Put message on queue -----;
%syscall mqput(hconn, hobj, hmd, hpmo,
    hdata, cc, reason);
%if &cc; ^= 0 %then %do;
    %put MQPUT: failed with reason= &reason;
    %goto exit;
%end;
%else %do;
    %put MQPUT: successfully put message on queue;

    /* inquire about message descriptor
       output parameters */
    %let action=INQ;
    %let parms=MSGID,PUTAPPLTYPE,PUTAPPLNAME,
        PUTDATE,PUTTIME;
    /* initialize msgid for return length of 48 */
    %let msgid="";
    %let appltype=0;
    /* initialize applname for return length of 28 */
    %let applname="";
    /* initialize data, time for return length of 8 */
    %let date="";
    %let time="";

    %syscall mqmd(hmd, action, rc, parms, msgid,
        appltype, applname, date, time);
    %if &rc; ^= 0 %then %do;
        %put MQMD: failed with rc= &rc;
        %put %sysfunc(sysmsg());
    %end;
    %else %do;
        %put Message descriptor output parameters are::
        %put MSGID= &msgid;
        %put PUTAPPLTYPE= &appltype;
        %put PUTAPPLNAME= &applname;
        %put PUTDATE= &date;
        %put PUTTIME= &time;
    %end;
%end;

%exit:
%if &hobj; ^= 0 %then %do;
    %put ----- Close queue -----;
    %let options=NONE;
    %syscall mqclose(hconn, hobj, options, cc, reason);
    %if &cc; ^= 0 %then %do;
        %put MQCLOSE: failed with reason= &reason;
    %end;
    %else %put MQCLOSE: successfully closed queue;
%end;

%if &hconn; ^= 0 %then %do;

```

```

%put ----- Disconnect from QMgr -----;
%syscall mqdisc(hconn, cc, reason);
%if &cc; ^= 0 %then %do;
    %put MQDISC: failed with reason= &reason;
%end;
%else %put MQDISC: successfully disconnected
    from QMgr;
%end;

%if &hod; ^= 0 %then %do;
    %syscall mqfree(hod);
    %put Object descriptor handle freed;
%end;
%if &hpmo; ^= 0 %then %do;
    %syscall mqfree(hpmo);
    %put Put message options handle freed;
%end;
%if &hmd; ^= 0 %then %do;
    %syscall mqfree(hmd);
    %put Message descriptor handle freed;
%end;
%if &hmap; ^= 0 %then %do;
    %syscall mqfree(hmap);
    %put Map descriptor handle freed;
%end;
%if &hdata; ^= 0 %then %do;
    %syscall mqfree(hdata);
    %put Data descriptor handle freed;
%end;

%mend putmsg;

/** invoke macro to Put a message on a queue **/
%putmsg;

%macro getmsg;
%let hconn=0;
%let hobj=0;
%let hod=0;
%let hgmo=0;
%let hmd=0;
%let hmap=0;
%put ----- Connect to QMgr -----;
%let qmgr=TEST;
%let cc=0;
%let reason=0;
%syscall mqconn(qmgr, hconn, cc, reason);
%if &cc; ^= 0 %then %do;
    %if &reason; = 2002 %then %do;
        %put Already connected to QMgr &qmgr;
    %end;
%end;

```

```

        %else %do;
            %if &reason; = 2059 %then
                %put MQCONN: QMgr not available...
                    needs to be started;
            %else
                %put MQCONN: failed with reason= &reason;
                %goto exit;
            %end;
    %end;
%else %put MQCONN: successfully connected
    to QMgr &qmgr;

%put ----- Generate object descriptor -----;
%let rc=0;
%let action=GEN;
%let parms=OBJECTNAME;
%let objname=TEST;
%syscall mqod(hod, action, rc, parms, objname);
%if &rc; ^= 0 %then %do;
    %put MQOD: failed with rc= &rc;
    %put %sysfunc(sysmsg());
    %goto exit;
%end;
%else %put MQOD: successfully generated
    object descriptor;

%put ----- Open queue object for input -----;
%let options=INPUT_SHARED;
%syscall mqopen(hconn, hod, options, hobj, cc, reason);
%if &cc; ^= 0 %then %do;
    %put MQOPEN: failed with reason= &reason;
    %goto exit;
%end;
%else %put MQOPEN: successfully opened queue for output;

%put ----- Generate get message options -----;
%syscall mqgmo(hgmo, action, rc);
%if &rc; ^= 0 %then %do;
    %put MQGMO: failed with rc= &rc;
    %put %sysfunc(sysmsg());
    %goto exit;
%end;
%else %put MQGMO: successfully generated get
    message options;

%put ----- Generate message descriptor -----;
%syscall mqmd(hmd, action, rc);
%if &rc; ^= 0 %then %do;
    %put MQMD: failed with rc= &rc;
    %put %sysfunc(sysmsg());

```

```

    %goto exit;
%end;
%else %put MQMD: successfully generated
    message descriptor;

%put ----- Generate map descriptor -----;
%let desc1=SHORT;
%let desc2=LONG;
%let desc3=DOUBLE;
%let desc4=CHAR,,50;
%syscall mqmap(hmap, rc, desc1, desc2, desc3, desc4);
%if &rc; ^= 0 %then %do;
    %put MQMAP: failed with rc= &rc;
    %put %sysfunc(sysmsg());
    %goto exit;
%end;
%else %put MQMAP: successfully generated map descriptor;

%put ----- Get message from queue -----;
%let msglen=0;
%syscall mqget(hconn, hobj, hmd, hgmo, msglen, cc,
    reason);
%if &cc; ^= 0 %then %do;
    %if &reason; = 2033 %then %put No message
        available;
    %else %put MQGET: failed with reason= &reason;
        %goto exit;
%end;
%else %do;
    %put MQGET: successfully retrieved message from queue;
    %put message length= &msglen;

    /* inquire about message descriptor
       output parameters */
    %let action=INQ;
    %let parms=REPORT,MSGTYPE,FEEDBACK,MSGID,CORRELID,
        USERIDENTIFIER,PUTAPPLTYPE,PUTAPPLNAME,PUTDATE,
        PUTTIME;
    /* initialize report for return length of 30 */
    %let report="                ";
    %let msgtype=0;
    %let feedback=0;
    /* initialize msgid, correlid for
       return length of 48 */
    %let msgid="                ";
    %let correlid="                ";
    /* initialize userid for return length of 12 */
    %let userid="                ";
    %let appltype=0;
    /* initialize applname for return length of 28 */
    %let applname="                ";
    /* initialilze data, time for return length of 8 */

```

```

%let date="      ";
%let time="      ";

%syscall mqmd(hmd, action, rc, parms, report,
             msgtype, feedback, msgid, correlid, userid,
             appltype, applname, date, time);
%if &rc; ^= 0 %then %do;
  %put MQMD: failed with rc &rc;
  %put %sysfunc(sysmsg());
%end;
%else %do;
  %put Message descriptor output parameters are;;
  %put REPORT= &report;
  %put MSGTYPE= &msgtype;
  %put FEEDBACK= &feedback;
  %put MSGID= &msgid;
  %put CORRELID= &correlid;
  %put USERIDENTIFIER= &userid;
  %put PUTAPPLTYPE= &appltype;
  %put PUTAPPLNAME= &applname;
  %put PUTDATE= &date;
  %put PUTTIME= &time;
%end;
%end;

%if &msglen; > 0 %then %do;
  /* retrieve SAS variables from GET buffer */
  %let parm1=0;
  %let parm2=0;
  %let parm3=0;
  /* initialize character return value length of 50 */
  %let parm4="      ";

  %syscall mqgetparms(hmap, rc, parm1,
                    parm2, parm3, parm4);
  %put Display SAS macro variables;;
  %put parm1= &parm1;
  %put parm2= &parm2;
  %put parm3= &parm3;
  %put parm4= &parm4;
  %if &rc; ^= 0 %then %do;
    %put MQGETPARMS: failed with rc= &rc;
    %put %sysfunc(sysmsg());
  %end;
%end;
%else %put No data associated with message;

%exit:
%if &hobj; ^= 0 %then %do;
  %put ----- Close queue -----;
  %let options=NONE;
  %syscall mqclose(hconn, hobj, options, cc, reason);

```

```

    %if &cc; ^= 0 %then %do;
        %put MQCLOSE: failed with reason= &reason;
    %end;
    %else %put MQCLOSE: successfully closed queue;
%end;

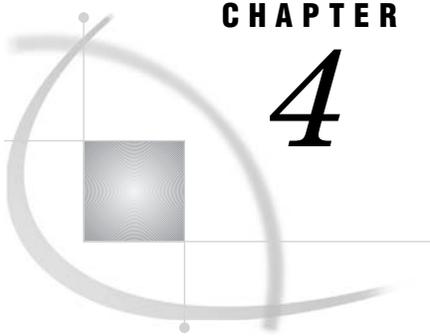
%if &hconn; ^= 0 %then %do;
    %put ----- Disconnect from QMgr -----;
    %syscall mqdisc(hconn, cc, reason);
    %if &cc; ^= 0 %then %do;
        %put MQDISC: failed with reason= &reason;
    %end;
    %else %put MQDISC: successfully
        disconnected from QMgr;
%end;

%if &hod; ^= 0 %then %do;
    %syscall mqfree(hod);
    %put Object descriptor handle freed;
%end;
%if &hgmo; ^= 0 %then %do;
    %syscall mqfree(hgmo);
    %put Get message options handle freed;
%end;
%if &hmd; ^= 0 %then %do;
    %syscall mqfree(hmd);
    %put Message descriptor handle freed;
%end;
%if &hmap; ^= 0 %then %do;
    %syscall mqfree(hmap);
    %put Map descriptor handle freed;
%end;

%mend getmsg;

/** invoke macro to Get a message from a queue **/
%getmsg;

```

CHAPTER

4

WebSphere MQ Call Routines

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Overview of MQ Call Routines

The SAS programming interface to MQSeries was designed to be as similar to WebSphere MQI as possible. Where WebSphere MQI requires a structure, the SAS programming interface requires a handle that represents a data structure. Each supported SAS CALL routine is documented in this section.

MQBACK

Backs out all WebSphere MQ message puts and gets since the last synchpoint.

Syntax

```
CALL MQBACK(hConn, compCode, reason);
```

Arguments

For the complete syntax information, see the *WebSphere MQ Application Programming Reference* at www.ibm.com.

Example

This example reverts the messages in a queue back to the last synchronization point.

```
compCode=0;  
reason=0;  
CALL MQBACK(hConn, compCode, reason);
```

MQCLOSE

Relinquishes access to a WebSphere MQ object (queue, process definition, queue manager).

Syntax

```
CALL MQCLOSE(hConn, hObj, options, compCode, reason);
```

Arguments

For the complete syntax information, see the *WebSphere MQ Application Programming Reference* at www.ibm.com.

Example

This example closes a queue.

```
options="NONE";  
compCode=0;  
reason=0;  
CALL MQCLOSE(hConn, hObj, options, compCode, reason);
```

MQCMIT

Commits all WebSphere MQ message puts and gets since the last synchpoint.

Syntax

```
CALL MQCMIT(hConn, compCode, reason);
```

Arguments

For the complete syntax information, see the *WebSphere MQ Application Programming Reference* at www.ibm.com.

Example

This example commits a unit of work.

```
compCode=0;  
reason=0;  
CALL MQCMIT(hConn, compCode, reason);
```

MQCONN

Connects Base SAS to a WebSphere MQ queue manager.

Syntax

```
CALL MQCONN(name, hConn, compCode, reason);
```

Arguments

For the complete syntax information, see the *WebSphere MQ Application Programming Reference* at www.ibm.com.

Example

The following example connects the Base SAS session to the queue manager named TEST.

```
hConn=0;
Name="TEST";
compCode=0;
reason=0;
CALL MQCONN(Name, hConn, compCode, reason);
```

MQDISC

Breaks the connection between a WebSphere MQ queue manager and Base SAS.

Syntax

```
CALL MQDISC(hConn, compCode, reason);
```

Arguments

For the complete syntax information, see the *WebSphere MQ Application Programming Reference* at www.ibm.com.

Example

The following example disconnects the Base SAS session from a queue manager identified by the parameter hConn.

```
compCode=0;
reason=0;
CALL MQDISC(hConn, compCode, reason);
```

MQFREE

Frees a Base SAS internal handle, thereby releasing its resources.

Syntax

```
CALL MQFREE(handle);
```

Arguments

handle

Numeric, input

Specifies the Base SAS internal handle that is obtained from one of the following previous function calls:

- MQPMO (*hpmo*)
- MQGMO (*hgmo*)
- MQOD (*hod*)
- MQMD (*hmd*)
- MQMAP (*hMap*)
- MQRMH (*hrmh*)
- MQSETPARMS (*hData*)

Example

This example frees the resources that are allocated by a handle.

```
CALL MQFREE(handle);
```

MQGET

Retrieves a message from a local WebSphere MQ queue that has been previously opened.

Syntax

```
CALL MQGET(hConn, hObj, hmd, hgmo, msglen, compCode, reason);
```

Arguments

hConn

Numeric, input

Specifies the WebSphere MQ connection handle that is obtained from a previous MQCONN function call.

hObj

Numeric, input

Specifies the WebSphere MQ handle to an open object that is obtained from a previous MQOPEN call.

hmd

Numeric, input

Specifies the Base SAS internal message descriptor handle that is obtained from a previous MQMD function call.

hgmo

Numeric, input

Specifies the Base SAS internal get message options handle that is obtained from a previous MQGMO function call.

msglen

Numeric, output

Returns the length of the received message. A length of zero signifies a message with no data. In that case, there is no need to call MQGETPARMS.

compCode

Numeric, output

Returns the WebSphere MQ completion code. This parameter can be used to determine whether an error occurred during the execution of this routine. If an error occurred, then the *compCode* parameter will be nonzero, and the *reason* parameter will be set to the appropriate reason code.

reason

Numeric, output

Returns the WebSphere MQ reason code that qualifies the completion code.

Note: A reason code of -1 reflects a Base SAS internal error, not a WebSphere MQ error. To obtain a textual description of a failure (either Base SAS or WebSphere MQ), use the SYMSG() Base SAS function call. △

Details

If data accompanies the message, it is retrieved into an internal Base SAS buffer. After the MQGET call completes, you should call MQGETPARMS to set Base SAS variables (parms) to that data or to retrieve the data into a physical binary or text file.

Example

This example gets a message from a queue.

```
msglen=0;
compCode=0;
reason=0;
CALL MQGET(hConn, hObj, hmd, hgmo, msglen,
compCode, reason);
```

MQGETPARMS

Retrieves values of Base SAS variables from a previous WebSphere MQ message that was received by an MQGET call.

Syntax

```
CALL MQGETPARMS(hMap, rc, parm1<,parm2, parm3, ...>);
```

Arguments

hMap

Numeric, input

Specifies a handle to a Base SAS internal map descriptor that is obtained from a previous MQMAP function call.

rc

Numeric, output

Provides the Base SAS return code from this function. If an error occurs, then the return code is nonzero. You can use the Base SAS function SYSMSG() to obtain a textual description of the return code.

parms

Numeric or character, output

Returns the Base SAS variables.

Note: Initialize variables appropriately to guarantee that truncation does not occur. \triangle

Details

This message is available until the next MQGET call is performed.

Example

This example gets values of Base SAS variables from a received message.

```
length parm1 parm2 parm3;
length parm4 $ 200;
rc=0;
CALL MQGETPARMS(hMap, rc, parm1, parm2, parm3, parm4);
```

MQGMO

Manipulates WebSphere MQ get message options to be used on a subsequent MQGET call.

Syntax

```
CALL MQGMO(hgmo, action, rc <,parms ,value1,value2, ...>);
```

Arguments

hgmo

Numeric, input or output

On input, it specifies a Base SAS internal get message options handle. The handle should be supplied when you are setting or querying an option. The handle is generated as output when *action* is to generate default WebSphere MQ get options.

action

Character, input

Specifies the desired action of this routine. The following *action* values are valid:

GEN

Generate a handle representing default get message options as defined by WebSphere MQ.

SET

After a get message options handle has been generated, you can continue to set values as necessary.

INQ

After a get message options handle has been generated, you can query its values.

rc

Numeric, output

Provides the Base SAS return code from this function. If an error occurs, then the return code is nonzero. You can use the Base SAS function SYSMSG() to obtain a textual description of the return code.

parms

Character, input

Specifies an optional string of get message options that you want to set for subsequent MQGET calls. Each option must be separated by a comma and must have a *value* associated with it in the function's parameter list.

value

Numeric or character, input or output

Provides the value for a get message option specified in the *parms* string. You must provide a *value* parameter for each option specified in the *parms* string and the data type must be of the proper type. Variables used to store character values being returned in an inquiry (INQ action) should be initialized appropriately to guarantee that truncation of a returned value does not occur.

The following get message options (*parms*) and *values* are valid:

OPTIONS

Character, input

Specifies a string of the attributes (options) to associate with subsequent MQGET calls. Each option must be separated by a comma.

The following OPTIONS values are valid:

NONE

Used to unset previously set OPTIONS

NO_WAIT (default)

Return immediately if no suitable message

WAIT

Wait for message to arrive

SYNCPOINT

Get message with synchpoint control

NO_SYNCPOINT

Get message without synchpoint control

BROWSE_FIRST

Browse from start of queue

BROWSE_NEXT

Browse from current position in queue

MSG_UNDER_CURSOR

Get message under browse cursor

LOCK

Lock message

This option is not supported on z/OS.

UNLOCK

Unlock message

This option is not supported on z/OS.

BROWSE_MSG_UNDER_CURSOR

Browse message under browse cursor

This option is not supported on z/OS.

FAIL_IF QUIESCING

Fail if QMgr is quiescing

CONVERT

Convert message data

The following **OPTIONS** values support WebSphere MQ Version 5.1 and later (these values are not supported on z/OS):

LOGICAL_ORDER

Messages in groups and segments of logical messages are returned in logical order.

COMPLETE_MSG

Only complete logical messages are retrievable.

ALL_MSGS_AVAILABLE

All messages in a group must be available.

ALL_SEGMENTS_AVAILABLE

All segments in a logical message must be available.

Notes:

- **ACCEPT_TRUNCATED_MSG** is not allowed since Base SAS internally maintains resizing of the internal **GET** buffer to handle any message size.
- Specify **CONVERT** to allow WebSphere MQ to perform data conversion based on the **FORMAT** of a **PUT** message via a conversion exit routine that has been previously established at the QMgr. To allow Base SAS to perform the data conversion instead of using a WebSphere MQ conversion exit routine, do not specify the **CONVERT** option.

WAITINTERVAL

Numeric, input

Amount of time to wait for message to arrive in milliseconds.

RESOLVEDQNAME

Character48, output

Resolved name of destination queue.

SASQSID

Character36, input

A value equal to the environment variable of the same name, a 36-character string. The environment variable can be retrieved using the following in a SAS **DATA** step:

```
sid = sysget('SASQSID');
```

For queues that are monitored by the object spawner, the `MsgDeliverySequence` property must be set to *Priority*. For more information about this option, see “Using Message Queue Polling with WebSphere MQ” on page 13.

The following get message options are supported by WebSphere MQ Version 5.1 and later:

MATCHOPTIONS

Character, input

Character string of match options that is used to control selection criteria that are associated with subsequent MQGET calls. Each option must be separated by a comma. The following MATCHOPTIONS values are valid:

NONE

No matches

MSGID

Retrieve message with specified message identifier

CORRELID

Retrieve message with specified correlation identifier

GROUPID

Retrieve message with specified group identifier

This option is not supported on z/OS.

SEQNUMBER

Retrieve message with specified sequence number

This option is not supported on z/OS.

OFFSET

Retrieve message with specified offset

This option is not supported on z/OS.

GROUPSTATUS

Character, output

Flag indicating whether message was retrieved within a group

SEGMENTSTATUS

Character, output

Flag indicating whether message was retrieved within a segment of a logical message

SEGMENTATION

Character, output

Flag indicating whether further segmentation is allowed for the retrieved message

Example

This example generates get message options to wait 3 seconds for a GET message operation.

```
hgmo=0;
action="GEN";
rc=0;
parms="OPTIONS,WAITINTERVAL";
options="WAIT";
interval=3000;
CALL MQGMO(hgmo, action, rc, parms, options, interval);
```

MQINQ

Queries the attributes of a WebSphere MQ object (queue, process definition, queue manager).

Syntax

```
CALL MQINQ(hConn, hObj, compCode, reason, parms, value1 <,value2, ...>);
```

Arguments

hConn

Numeric, input

Specifies the WebSphere MQ connection handle that is obtained from a previous MQCONN function call.

hObj

Numeric, input

Specifies the WebSphere MQ Object handle that is obtained from a previous MQOPEN function call that specified the INQUIRE option. This handle can represent a queue, process definition, or queue manager object.

compCode

Numeric, output

Returns the WebSphere MQ completion code. This parameter can be used to determine whether an error occurred during the execution of this routine. If an error occurred, then the *compCode* parameter will be nonzero, and the *reason* parameter will be set to the appropriate reason code.

reason

Numeric, output

Returns the WebSphere MQ reason code that qualifies the completion code.

Note: A reason code of -1 reflects a Base SAS internal error, not a WebSphere MQ error. To obtain a textual description of a failure (either Base SAS or WebSphere MQ), use the SYSMSG() Base SAS function call. Δ

parms

Character, input

Specifies a string of attributes that you want to query from the WebSphere MQ object. Each object attribute is separated by a comma. The value that is associated with each attribute is returned in a *value* parameter. Not all attributes are valid for each type of object (queue, process definition, or queue manager). Valid object types are listed under each attribute.

value

Numeric or character, output

Returns the value for an attribute specified in the *parms* string. You must provide a *value* parameter for each attribute specified *parms* string. Variables used to store

character *values* should be initialized appropriately to guarantee that truncation of a returned value does not occur.

The attributes in the following three tables are valid.

Table 4.1 Attributes for Queues

Attribute	Data Type	Description
ALTERATION_DATE	Character12	Date definition last changed
ALTERATION_TIME	Character8	Time definition was last changed
BACKOUT_REQ_Q_NAME	Character48	Excessive backout requeue name
BACKOUT_THRESHOLD	Numeric	Backout threshold
BASE_Q_NAME	Character48	Name of queue to which alias resolves
CF_STRUC_NAME	Character12	Coupling-facility structure name (z/OS only)
CLUSTER_NAME	Character48	Name of cluster to which queue belongs
CLUSTER_NAMELIST	Character48	Name of namelist containing names of clusters to which queue belongs
CLUSTER_WORKLOAD_DATA	Character32	User data for cluster workload exit
CLUSTER_WORKLOAD_LENGTH	Numeric	Maximum length of message data passed to cluster workload exit
CREATION_DATE	Character12	Queue creation date
CREATION_TIME	Character8	Queue creation time
CURRENT_Q_DEPTH	Numeric	Number of messages on queue
DEF_BIND	Numeric	Default binding
DEF_INPUT_OPEN_OPTION	Numeric	Default open-for-input option
DEF_PERSISTENCE	Numeric	Default message persistence
DEF_PRIORITY	Numeric	Default message priority
DEF_XMIT_Q_NAME	Character48	Default transmission queue name
DEFINITION_TYPE	Numeric	Queue definition type
EXPIRY_INTERVAL	Numeric	Interval between scans for expired messages (z/OS only)
HARDEN_GET_BACKOUT	Numeric	Whether to harden backout count
IGQ_PUT_AUTHORITY	Numeric	Intra-group queuing put authority (z/OS only)
IGQ_USER_ID	Character12	Intra-group queuing agent user ID (z/OS only)
INDEX_TYPE	Numeric	Index type (z/OS only)

Attribute	Data Type	Description
INHIBIT_GET	Numeric	Whether get operations are allowed This output type is not supported on z/OS.
INHIBIT_PUT	Numeric	Whether put operations are allowed
INITIATION_Q_NAME	Character48	Initiation queue name
INTRA_GROUP_QUEUEING	Numeric	Intra-group queuing support (z/OS only)
MAX_MSG_LENGTH	Numeric	Maximum message length
MAX_Q_DEPTH	Numeric	Maximum number of messages allowed on queue
MSG_DELIVERY_SEQUENCE	Numeric	Whether message priority is relevant
OPEN_INPUT_COUNT	Numeric	Number of MQOPEN calls that have the queue open for input
OPEN_OUTPUT_COUNT	Numeric	Number of MQOPEN calls that have the queue open for output
PROCESS_NAME	Character32	Name of process definition
Q_DEPTH_HIGH_EVENT	Numeric	Control attribute for queue depth high events This output type is not supported on z/OS.
Q_DEPTH_HIGH_LIMIT	Numeric	High limit for queue depth This output type is not supported on z/OS.
Q_DEPTH_LOW_EVENT	Numeric	Control attribute for queue depth low events This output type is not supported on z/OS.
Q_DEPTH_LOW_LIMIT	Numeric	Low limit for queue depth This output type is not supported on z/OS.
Q_DEPTH_MAX_EVENT	Numeric	Control attribute for queue depth max events This output type is not supported on z/OS.
Q_DESC	Character64	Queue description
Q_NAME	Character48	Queue name
Q_SERVICE_INTERVAL	Numeric	Limit for queue service interval This output type is not supported on z/OS.

Attribute	Data Type	Description
Q_SERVICE_INTERVAL_EVENT	Numeric	Control for queue service interval events This output type is not supported on z/OS.
Q_TYPE	Numeric	Queue type
QSG_DISP	Numeric	Queue-sharing group disposition (z/OS only)
QSG_NAME	Character4	Name of queue-sharing group (z/OS only)
REMOTE_Q_MGR_NAME	Character48	Name of remote queue manager
REMOTE_Q_NAME	Character48	Name of remote queue as known on remote queue manager
RETENTION_INTERVAL	Numeric	Queue retention interval
SCOPE	Numeric	Queue definition scope This output type is not supported on z/OS.
SHAREABILITY	Numeric	Whether queue can be shared
STORAGE_CLASS	Character8	Storage class for queue (z/OS only)
TRIGGER_CONTROL	Numeric	Trigger control
TRIGGER_DATA	Character64	Trigger data
TRIGGER_DEPTH	Numeric	Trigger depth
TRIGGER_MSG_PRIORITY	Numeric	Threshold message priority for triggers
TRIGGER_TYPE	Numeric	Trigger type
USAGE	Numeric	Usage
XMIT_Q_NAME	Character48	Default transmission queue name

Table 4.2 Attributes for Queue Managers

Attribute	Data Type	Description
AUTHORITY_EVENT	Numeric	Control attribute for authority events This output type is not supported on z/OS.
CLUSTER_WORKLOAD_EXIT (MQ_EXIT_NAME_LENGTH)	Character Variable Length	Name of user exit for cluster workload management
CODED_CHAR_SET_ID	Numeric	Coded character set identifier
COMMAND_INPUT_Q_NAME	Character48	System command input queue name
COMMAND_LEVEL	Numeric	Command level supported by queue manager
DEAD_LETTER_Q_NAME	Character48	Dead letter queue name

Attribute	Data Type	Description
INHIBIT_EVENT	Numeric	Control attribute for inhibit events This output type is not supported on z/OS.
LOCAL_EVENT	Numeric	Control attribute for local events This output type is not supported on z/OS.
MAX_HANDLES	Numeric	Maximum number of handles
MAX_MSG_LENGTH	Numeric	Maximum message length
MAX_PRIORITY	Numeric	Maximum priority
MAX_UNCOMMITTED_MSGS	Numeric	Maximum number of uncommitted messages within a unit of work This output type is not supported on z/OS.
PERFORMANCE_EVENT	Numeric	Control attribute for performance events This output type is not supported on z/OS.
PLATFORM	Numeric	Platform on which the queue manager resides
Q_MGR_DESC	Character64	Queue manager description
Q_MGR_IDENTIFIER	Character48	Unique internally generated identifier of queue manager
Q_MGR_NAME	Character48	Queue manager name
REMOTE_EVENT	Numeric	(Queue Manager) Control attribute for remote events This output type is not supported on z/OS.
REPOSITORY_NAME	Character48	Name of cluster for which this queue manager provides repository services
REPOSITORY_NAMELIST	Character48	Name of namelist object containing names of clusters for which this queue manager provides repository services
SYNCPOINT	Numeric	(Queue Manager) Synchpoint availability

Attribute	Data Type	Description
START_STOP_EVENT	Numeric	(Queue Manager) Control attribute for start stop events This output type is not supported on z/OS.
TRIGGER_INTERVAL	Numeric	(Queue Manager) Trigger interval

Table 4.3 Attributes for Process Definitions

Attribute	Data Type	Description
APPL_ID	Character256	Application identifier
APPL_TYPE	Numeric	(Process Definition) Application type
ENV_DATA	Character128	Environment data
PROCESS_DESC	Character48	Description of process definition
PROCESS_NAME	Character32	Name of process definition
USER_DATA	Character128	User data

Example

This example queries about a queue's maximum depth and the maximum message length.

```
length parms $ 30;
compCode=0;
reason=0;
parms="MAX_Q_DEPTH,MAX_MSG_LENGTH";
CALL MQINQ(hConn, hObj, compCode,
reason, parms, maxdepth, maxmsgl);
```

MQMAP

Defines a data map that can be subsequently used on an MQSETPARMS or MQGETPARMS call.

Syntax

```
CALL MQMAP(hMap, rc, desc1 <,desc2, desc3, ...>);
```

Arguments

hMap

Numeric, output

Returns a Base SAS internal map descriptor handle. The handle generated will be used to reference the data map when setting or getting Base SAS variables in a message.

rc

Numeric, output

Provides the Base SAS return code from this function. If an error occurs, then the return code is nonzero. You can use the Base SAS function SYSMSG() to obtain a textual description of the return code.

descs

Character, input

Specifies a data map descriptor that defines the data type, data offset from the beginning of the message, and data length. A descriptor has the following format:

```
"TYPE<,OFFSET,LENGTH>"
```

TYPE can be one of the following values:

- CHAR (character data)
- SHORT (short integer)
- LONG (long integer)
- DOUBLE (double precision floating point)

OFFSET is the offset from beginning of the message. This property is optional so that by default data is not aligned (data starts at next available position in message).

LENGTH is the length of the data being represented. This property is optional in most cases. The only time length is required is when setting up to receive character data. Specifying length for numeric data is ignored since length is implicitly defined.

Note: Type coercion is performed transparently when you put Base SAS variables into a WebSphere MQ message (MQSETPARMS) and also when you get Base SAS variables from a WebSphere MQ message (MQGETPARMS). That is, if the data that you are sending or receiving is of a different type than the Base SAS variable itself, the data will be coerced into the appropriate data type. Δ

Example

This example defines a map to use to send and receive a message with a short, a long, a double, and a character string. No alignment is specified for any data type, and strings are always 200 characters in length (blank padded).

```
hMap=0;
rc=0;
desc1="SHORT";
desc2="LONG";
desc3="DOUBLE";
desc4="CHAR,,200";
CALL MQMAP(hMap, rc, desc1, desc2, desc3, desc4);
```

MQMD

Manipulates message descriptor parameters to be used on a subsequent MQPUT, MQPUT1, or MQGET call.

Syntax

```
CALL MQMD(hmd, action, rc <parms ,value1, value2, ...>);
```

Arguments

hmd

Numeric, input or output

On input, specifies a Base SAS internal message descriptor handle. The handle should be supplied when you are setting or querying a value. The handle is generated as output when *action* is to generate default "message descriptor" parameters.

action

Character, input

Specifies the desired action of this routine. The following *action* values are valid:

GEN

Generate a handle that represents default message descriptor parameters as defined by WebSphere MQ.

SET

After a message descriptor handle has been generated, you can continue to set values as necessary.

INQ

After a message descriptor handle has been generated, you can query its values.

rc

Numeric, output

Provides the Base SAS return code from this function. If an error occurs, then the return code is nonzero. You can use the Base SAS function SYSMSG() to obtain a textual description of the return code.

parms

Character, input

Specifies an optional string of message descriptor parameters that you want to set for subsequent MQPUT, MQPUT1, or MQGET calls. Each parameter must be separated by a comma and must have a *value* associated with it in the function's parameter list.

value

Numeric or character, input or output

Provides a value for a message descriptor parameter specified in the *parms* string. You must provide a *value* parameter for each message descriptor parameter specified in the *parms* string and the data type must be of the proper type. Variables used to store character values that are being returned in an inquiry (INQ action) should be initialized appropriately to guarantee that truncation of a returned value does not occur.

Note: This routine supports both sending a message (MQPUT and MQPUT1) and receiving a message (MQGET). Therefore, the parameters and values serve as both input and as output to the function. △

For a list of the parameters that you can specify, see the documentation for the MQMD structure in the *WebSphere MQ Application Programming Reference* at www.ibm.com.

Notes:

- ENCODING and CODEDCHARSETID should not be set in most situations since you want a message to be described by its native numeric and character encoding, which are the default attributes for these parms.
- FORMAT should be set if you intend for a WebSphere MQ QMgr conversion exit to be invoked when an application GETs a message. The FORMAT name is the actual name of the conversion exit that is invoked when an application GETs a message with the CONVERT get message option specified. The FORMAT name in the message descriptor is set when a message is PUT on a queue. Refer to WebSphere MQ literature for details on creating a conversion exit.
- MSGID and CORRELID are updated on PUTs and GETs, so remember to reset their values appropriately when performing multiple PUTs or GETs with the same message descriptor.

Example

This example sends a message to a queue, and then queries and displays the message descriptor values.

```
length parms $ 57;
length report $ 30 msgtype $ 8 msgid $ 48 correlid $48
  applname $ 28 putdate $ 8 puttime $ 8;

/* generate a message descriptor to PUT a persistent */
/* message on a permanent queue */
hmd=0;
action="GEN";
rc=0;
parms="PERSISTENCE"
persist="PERSISTENT";
CALL MQMD(hmd, action, rc, parms, persist);

/* inquire about message descriptor values after GET */
/* operation completes successfully */
action="INQ";
parms="REPORT,MSGTYPE,MSGID,CORRELID,
  PUTAPPLNAME,PUTDATE,PUTTIME";
CALL MQMD(hmd, action, rc, parms, report, msgtype,
  msgid, correlid, applname, putdate, puttime);

put 'report type is ' report;
put 'message type is ' msgtype;
put 'message id is ' msgid;
put 'correlation id is ' correlid;
put 'put application name is ' applname;
put 'put date is ' putdate;
put 'put time is ' puttime;
```

MQOD

Manipulates object descriptor parameters to be used on a subsequent MQOPEN or MQPUT1 call.

Syntax

```
CALL MQOD(hod, action, rc <parms ,value1, value2, ...>);
```

Arguments

hod

Numeric, input or output

On input, it specifies a Base SAS internal object descriptor handle. The handle should be supplied when you are setting or querying a value. The handle is generated as output when *action* is to generate default object descriptor parameters.

action

Character, input

Specifies the desired action of this routine. The following *action* values are valid:

GEN

Generate a handle representing default object descriptor parameters as defined by WebSphere MQ.

SET

After an object descriptor handle has been generated, you can continue to set values as necessary.

INQ

After an object descriptor handle has been generated, you can query its values.

rc

Numeric, output

Provides the Base SAS return code from this function. If an error occurs, then the return code is nonzero. You can use the Base SAS function SYSMSG() to obtain a textual description of the return code.

parms

Character, input

Specifies an optional string of object descriptor parameters that you want to set for subsequent MQOPEN or MQPUT1 calls. Each parameter must be separated by a comma and must have a *value* associated with it in the function's parameter list.

value

Numeric or character, input or output

Provides a value for an object descriptor parameter specified in the *parms* string. You must provide a *value* parameter for each object descriptor parameter specified in the *parms* string and the data type must be of the proper type. Variables used to store character values being returned in an inquiry (INQ action) should be initialized appropriately to guarantee that truncation of a returned value does not occur.

For a list of the parameters that you can specify, see the documentation for the MQOD structure in the *WebSphere MQ Application Programming Reference* at www.ibm.com.

Example

This example generates an object descriptor to OPEN a temporary dynamic queue that begins with the name Base SAS and is unique within the system. The example then queries the name of the temporary dynamic queue that was created after a successful OPEN.

```
length qname $ 48;
hod=0;
action="GEN";
rc=0;
parms="OBJECTNAME,DYNAMICQNAME"
model="SAMPLE.TEMP.MODEL";
qname="SAS*";
CALL MQOD(hod, action, rc, parms, model, qname);
action="INQ";
parms="OBJECTNAME";
CALL MQOD(hod, action, rc, parms, qname);
put 'dynamic queue name = ' qname;
```

MQOPEN

Establishes access to a WebSphere MQ object (queue, process definition, or queue manager).

Syntax

```
CALL MQOPEN(hConn, hod, options, hObj, compCode, reason <, compCode1, reason1,
            compCode2, reason2, ...>);
```

Arguments

hConn

Numeric, input

Specifies the WebSphere MQ connection handle that is obtained from a previous MQCONN function call.

hod

Numeric, input

Specifies the Base SAS internal object descriptor handle that is obtained from a previous MQOD function call.

options

Character, input

Specifies a string of open options, each separated by a comma. The following open options are valid:

INPUT_AS_Q_DEF

Open to get messages using queue-defined default.

INPUT_SHARED

Open to get messages with shared access.

INPUT_EXCLUSIVE

Open to get messages with exclusive access.

BROWSE

Open to browse messages.

OUTPUT

Open to put messages.

INQUIRE

Open to query object attributes.

SET

Open to set object attributes.

SAVE_ALL_CONTEXT

Save context when message is received.

PASS_IDENTITY_CONTEXT

Allow identity context to be passed.

PASS_ALL_CONTEXT

Allow all context to be passed.

SET_IDENTITY_CONTEXT

Allow identity context to be set.

SET_ALL_CONTEXT

Allow all context to be set.

ALTERNATE_USER_AUTHORITY

Validate with specified user identifier.

FAIL_IF QUIESCING

Fail if QMgr is quiescing.

The following options apply only when opening a cluster queue:

BIND_AS_Q_DEF

Use default binding for queue.

BIND_NOT_FIXED

Do not bind to a specific destination.

BIND_ON_OPEN

Bind handle to destination when queue is opened.

hObj

Numeric, output

Returns the WebSphere MQ handle that will be used in subsequent message queuing calls to identify the object that is being accessed (a queue, a process definition, or queue manager).

compCode

Numeric, output

Returns the WebSphere MQ completion code. This parameter can be used to determine whether an error occurred during the execution of this routine. If an error occurred, then the *compCode* parameter will be nonzero, and the *reason* parameter will be set to the appropriate reason code.

reason

Numeric, output

Returns the WebSphere MQ reason code that qualifies *compCode*.

Note: A reason code of -1 reflects a Base SAS internal error, not a WebSphere MQ error. To obtain a textual description of a failure (either Base SAS or WebSphere MQ), use the SYMSG() Base SAS function call. △

compCodex, reasonx

Numeric, output

The *compCodex* and *reasonx* are an optional series of paired values that can be used when opening a distribution list in order to discern failures for specific queues within the distribution list. These parameters support features of WebSphere MQ Version 5.1 and later.

Example

This example opens a queue for input and output.

```
options="INPUT_SHARED,OUTPUT";
hObj=0;
compCode=0;
reason=0;
CALL MQOPEN(hConn, hod, options, hObj,
compCode, reason);
```

MQPMO

Manipulates WebSphere MQ put message options to be used on a subsequent MQPUT call.

Syntax

```
CALL MQPMO(hpmo, action, rc <,parms ,value1, value2, ...>);
```

Arguments

hpmo

Numeric, input or output

On input, it specifies the Base SAS internal put message options handle. The handle should be supplied when you are setting or querying an option. The handle is generated as output when *action* is to generate default WebSphere MQ put options.

action

Character, input

Specifies the desired action of this routine. The following *action* values are valid:

GEN

Generate a handle representing default put message options as defined by WebSphere MQ.

SET

After a put message options handle has been generated, you can continue to set values as necessary.

INQ

After a put message options handle has been generated, you can query its values.

rc

Numeric, output

Provides the Base SAS return code from this function. If an error occurs, then the return code is nonzero. You can use the Base SAS function SYSMSG() to obtain a textual description of the return code.

parms

Character, input

Specifies an optional string of put message options that you want to set for subsequent MQPUT calls. Each option must be separated by a comma and must have a *value* associated with it in the function's parameter list.

value

Numeric or character, input or output

Provides the value for an option specified in the *parms* string. You must provide a *value* parameter for each option specified in the *parms* string and the data type must be of the proper type. Variables used to store character values that are being returned in an inquiry (INQ action) should be initialized appropriately to guarantee that truncation of a returned value does not occur.

The following put message options (*parms*) are valid:

CONTEXT

Numeric, input

Object handle of input queue.

RESOLVEDQNAME

Character48, output

Resolved name of destination queue.

RESOLVEDQMGRNAME

Character48, output

Resolved name of destination queue manager.

OPTIONS

Character, input

Character string of the attributes (options) to associate with subsequent MQPUT calls. Each option must be separated by a comma.

The following OPTIONS values are valid:

NONE

Default

SYNCPOINT

Put message inside current unit of work

NO_SYNCPOINT

Put message outside current unit of work

DEFAULT_CONTEXT

Associate default context with the message

PASS_IDENTITY_CONTEXT

Pass identity context from an input queue handle

PASS_ALL_CONTEXT

Pass all context from an input queue handle

SET_IDENTITY_CONTEXT
 Set identity context from the application

SET_ALL_CONTEXT
 Set all context from the application

ALTERNATE_USER_AUTHORITY
 Validate with specified user identifier

FAIL_IF QUIESCING
 Fail if QMgr is quiescing

NO_CONTEXT
 Associate no context with the message
 The following OPTIONS values support WebSphere MQ Version 5.1 and later
 (these values are not supported on z/OS):

NEW_MSGID
 Generate a new message identifier

NEW_CORRELID
 Generate a new correlation identifier

LOGICAL_ORDER
 Messages in groups and segments are put in logical order

Example

This example demonstrates the generate, set, and inquire actions of MQPMO routine.

```

length parms $ 30;
length rq rqmgr $ 48;
/* generate default put message options */
hpmo=0;
action="GEN";
rc=0;
CALL MQPMO(hpmo, action, rc);
/* set non-default put message options parameters */
action="SET";
parms="OPTIONS";
options="SYNCPOINT,FAIL_IF QUIESCING";
CALL MQPMO(hpmo, action, rc, parms, options);
/* inquire about resolved names after successful PUT */
action="INQ";
parms="RESOLVEDQNAME,RESOLVEDQMGRNAME";
CALL MQPMO(hpmo, action, rc, parms, rq, rqmgr);

```

MQPUT

Puts a message on a WebSphere MQ queue that has been previously opened.

Syntax

```

CALL MQPUT(hConn, hObj, hmd, hpmo, hData, compCode, reason <, compCode1,
reason1, compCode2, reason2, ...>);

```

Arguments

hConn

Numeric, input

Specifies the WebSphere MQ Connection handle that is obtained from a previous MQCONN function call.

hObj

Numeric, input

Specifies the WebSphere MQ handle to an open object that is obtained from a previous MQOPEN call.

hmd

Numeric, input

Specifies the Base SAS internal message descriptor handle that is obtained from a previous MQMD function call.

hpmo

Numeric, input

Specifies the Base SAS internal put message options handle that is obtained from a previous MQPMO function call.

hData

Numeric, input

Specifies the Base SAS internal data descriptor handle that is obtained from a previous MQSETPARMS function call. If set to zero, then it is assumed that no data will accompany this message. For WebSphere MQ Version 5.1 and later, *hData* can also represent a reference message header that is obtained from a previous MQRMH function call.

compCode

Numeric, output

Returns the WebSphere MQ completion code. This parameter can be used to determine whether an error occurred during the execution of this routine. If an error occurred, then the *compCode* parameter will be nonzero, and the *reason* parameter will be set to the appropriate reason code.

reason

Numeric, output

Returns the WebSphere MQ reason code that qualifies *compCode*.

Note: A reason code of -1 reflects a Base SAS internal error, not a WebSphere MQ error. To obtain a textual description of a failure (either Base SAS or WebSphere MQ), use the SYSMSG() Base SAS function call. △

compCodex, reasonx

Numeric, output

The *compCodex* and *reasonx* are an optional series of paired values that can be used when opening a distribution list in order to discern failures for specific queues within the distribution list. These parameters support features of WebSphere MQ Version 5.1 and later.

Example

This example sends a message to a queue.

```
compCode=0;
reason=0;
```

```
CALL MQPUT(hConn, hObj, hmd, hpmo, hData,
           compCode, reason);
```

MQPUT1

Sends a single message, often a reply, to a queue.

Syntax

```
CALL MQPUT1(hConn, hObj, hmd, hpmo, hData, compCode, reason <, compCode1,
           reason2, compCode2, reason2, ...>);
```

Arguments

hConn

Numeric, input

Specifies the WebSphere MQ connection handle that is obtained from a previous MQCONN function call.

hObj

Numeric, input

Specifies the Base SAS internal object descriptor handle that is obtained from a previous MQOD function call.

hmd

Numeric, input

Specifies the Base SAS internal message descriptor handle that is obtained from a previous MQMD function call.

hpmo

Numeric, input

Specifies the Base SAS internal put message options handle that is obtained from a previous MQPMO function call.

hData

Numeric, input

Specifies the Base SAS internal data descriptor handle that is obtained from a previous MQSETPARMS function call. If set to zero, then it is assumed that no data will accompany this message. For WebSphere MQ Version 5.1 and later, *hData* can also represent a reference message header that is obtained from a previous MQRMH function call.

compCode

Numeric, output

Returns the WebSphere MQ completion code. This parameter can be used to determine whether an error occurred during the execution of this routine. If an error occurred, then the *compCode* parameter will be nonzero, and the *reason* parameter will be set to the appropriate reason code.

reason

Numeric, output

Returns the WebSphere MQ reason code that qualifies the completion code.

Note: A reason code of -1 reflects a Base SAS internal error, not a WebSphere MQ error. To obtain a textual description of a failure (either Base SAS or WebSphere MQ), use the SYSMSG() Base SAS function call. △

compCodex, reasonx

Numeric, output

The *compCodex* and *reasonx* are an optional series of paired values that can be used when opening a distribution list in order to discern failures for specific queues within the distribution list. These parameters support features of WebSphere MQ Version 5.1 and later.

Details

Essentially, the MQPUT1 routine performs an MQOPEN, MQPUT and MQCLOSE in one API call. The queue does not have to be open before you make this call. Also note that the queue will be closed during the execution of this call.

Example

This example sends a message to a queue that might not already be opened.

```
compCode=0;
reason=0;
CALL MQPUT1(hConn, hod, hmd, hpmo, hData,
compCode, reason);
```

MQRMH

Creates or manipulates a reference message header so that an application can put a message in this format, omitting the bulk data.

Syntax

```
CALL MQRMH(hrmh, action, rc, parms, value1, value2, ...);
```

Arguments

hrmh

Numeric, input or output

Specifies a Base SAS internal handle to a reference message header. The handle is generated as output when *action* is to generate default message header parameters. The handle should be supplied when you are setting or querying a parameter.

action

Character, input

Specifies the desired action of this routine. The following *action* values are valid:

GEN

Generate a handle representing default reference message header parameters as defined by WebSphere MQ.

SET

After a message header handle has been generated, you can set values as necessary.

INQ

After a message header handle has been generated, you can query its values.

rc

Numeric, output

Provides the Base SAS return code from this function. If an error occurs, then the return code is nonzero. You can use the Base SAS function SYSMSG() to obtain a textual description of the return code.

parms

Character, input

Specifies an optional string of reference message header parameters that you want to set. Each parameter must be separated by a comma and must have a *value* associated with it in the function's parameter list. The OBJECTTYPE, SRCNAME, and DESTNAME parameters should be defined.

value

Numeric or character, input or output

Provides a value for a reference message header parameter that is specified in the *parms* string. You must provide a *value* parameter for each reference message header parameter that is specified in the *parms* string and the data type must be of the proper type. Variables that are used to store character values being returned in an inquiry (INQ action) should be initialized appropriately to guarantee that truncation of a returned value does not occur.

The following reference message header parameters (*parms*) and *values* are valid:

ENCODING

Numeric, input
Data encoding

CODEDCHARSETID

Numeric, input
Coded character set identifier

FORMAT

Character8, input
Format name

OBJECTTYPE

Character8, input
Object type

SRCNAME

Character, input
Source object name

DESTNAME

Character, input
Destination object name

Details

When the reference message header is read from the transmission queue by a message channel agent (MCA), a user-supplied message exit is invoked to process the reference message. A sample message exit is supplied by WebSphere MQ, amqsxrm. You must add this message exit to the sending and receiving channel definitions. The message exit on the sending side can append to the reference message the bulk data identified by the reference message header before the MCA sends the message through the channel to the next queue manager.

When a reference message is received, the receiving message exit should create the object from the bulk data that is associated with the reference message header, and then pass on the reference message without the bulk data so that the reference message (without the bulk data) can later be retrieved by a program.

Example

This example goes through the process of connecting to a queue manager, preparing the queue, generating the message, closing the queue, and freeing all resources.

```

data _null_;
length hconn hobj cc reason 8;
length rc hod hpmo hmd hrmh 8;
length msg $ 200;

hconn=0;
hobj=0;
hod=0;
hpmo=0;
hmd=0;
hrmh=0;

put '----- Connect to QMgr -----';
call mqconn("TESTQMGR", hconn, cc, reason);
if cc ^= 0 then do;
  if reason = 2002 then do;
    put 'Already connected to QMgr ' qmgr;
  end;
else do;
  if reason = 2059 then
    put 'MQCONN: QMgr not available...
      needs to be started';
  else
    put 'MQCONN: failed with reason= ' reason;
    goto exit;
  end;
end;
else put 'MQCONN: successfully connected to QMgr ' qmgr;

put '----- Generate object descriptor -----';
call mqod(hod, "GEN", rc, "OBJECTNAME", "TESTQ");
if rc ^= 0 then do;
  put 'MQOD: failed with rc= ' rc;
  msg = sysmsg();
  put msg;

```

```

        goto exit;
    end;
    else put 'MQOD: successfully generated
            object descriptor';

    put '----- Open queue object for output -----';
    call mqopen(hconn, hod, "OUTPUT", hobj, cc, reason);
    if cc ^= 0 then do;
        put 'MQOPEN: failed with reason= ' reason;
        goto exit;
    end;
    else put 'MQOPEN: successfully opened queue for output';

    put '----- Generate put message options -----';
    call mqpmo(hpmo, "GEN", rc);
    if rc ^= 0 then do;
        put 'MQPMO: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
    else put 'MQPMO: successfully generated put
            message options';

    put '----- Generate message descriptor -----';
    /* format must be set to reference message header */
    call mqmd(hmd, "GEN", rc, "PERSISTENCE,FORMAT",
             "PERSISTENT", "MQHREF");
    if rc ^= 0 then do;
        put 'MQMD: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
    else put 'MQMD: successfully generated
            message descriptor';

    /** reference message header **/
    call mqrmh(hrmh, "GEN", rc,
             "SRCNAME,DESTNAME,OBJECTTYPE",
             "d:\test.txt", "d:\testdup.txt", "FLATFILE");
    if rc ^= 0 then do;
        put 'MQRMH: failed with rc= ' rc;
        msg = sysmsg();
        put msg;
        goto exit;
    end;
    else put 'MQRMH: successfully generated reference
            message header';

    put '----- Put message on queue -----';

```

```

call mqput(hconn, hobj, hmd, hpmo, hrmh, cc, reason);
if cc ^= 0 then do;
    put 'MQPUT: failed with reason= ' reason;
    msg = sysmsg();
    put msg;
    goto exit;
end;
else put 'MQPUT: successfully put message on queue';

exit:
if hobj ^= 0 then do;
    put '----- Close queue -----';
    call mqclose(hconn, hobj, "NONE", cc, reason);
    if cc ^= 0 then do;
        put 'MQCLOSE: failed with reason= ' reason;
    end;
    else put 'MQCLOSE: successfully closed queue';
end;

if hconn ^= 0 then do;
    put '----- Disconnect from QMgr -----';
    call mqdisc(hconn, cc, reason);
    if cc ^= 0 then do;
        put 'MQDISC: failed with reason= ' reason;
    end;
    else put 'MQDISC: successfully disconnected
            from QMgr';
end;

if hod ^= 0 then do;
    call mqfree(hod);
    put 'Object descriptor handle freed';
end;
if hpmo ^= 0 then do;
    call mqfree(hpmo);
    put 'Put message options handle freed';
end;
if hmd ^= 0 then do;
    call mqfree(hmd);
    put 'Message descriptor handle freed';
end;
if hrmh ^= 0 then do;
    call mqfree(hrmh);
    put 'Reference message header handle freed';
end;
run;

```

MQSET

Changes the attributes of a queue object.

Syntax

```
CALL MQSET(hConn, hObj, compCode, reason, parms, value1 <value2, ...>);
```

Arguments

hConn

Numeric, input

Specifies the WebSphere MQ connection handle that is obtained from a previous MQCONN function call.

hObj

Numeric, input

Specifies the WebSphere MQ object handle that is obtained from a previous MQOPEN function call that specified the SET option. This handle represents a queue object.

compCode

Numeric, output

Returns the WebSphere MQ completion code. This parameter can be used to determine whether an error occurred during the execution of this routine. If an error occurred, then the *compCode* parameter will be nonzero, and the *reason* parameter will be set to the appropriate reason code.

reason

Numeric, output

Returns the WebSphere MQ reason code that qualifies the completion code.

Note: A reason code of -1 reflects a Base SAS internal error, not a WebSphere MQ error. To obtain a textual description of a failure (either Base SAS or WebSphere MQ), use the SYMSG() Base SAS function call. Δ

parms

Character, input

Specifies a string of queue attributes that you want to set for a WebSphere MQ queue. Each queue attribute must be separated by a comma and must have a value associated with it. Only certain attributes (a subset of list for MQINQ) can be changed by using this function call. Refer to the IBM WebSphere MQ documentation for more details.

value

Numeric or character, input

Provides the value for an attribute that is specified in the *parms* string. You must provide a *value* parameter for each attribute that is specified in the *parms* string, and the data type must be of the proper type.

Example

This example changes the queue properties by inhibiting messages to be sent (put) to the queue.

```

length parms $ 30;
compCode=0;
reason=0;
parms="INHIBIT_PUT";
inhibit=1;
CALL MQSET(hConn, hObj, compCode,
reason, parms, inhibit);

```

MQSETPARMS

Creates a data descriptor that describes the actual Base SAS variables along with an associated data mapping. This data descriptor can then be used on a subsequent MQPUT or MQPUT1 call.

Syntax

```
CALL MQSETPARMS(hData, hMap, rc, parm1 <,parm2, parm3, ...>);
```

Arguments

hData

Numeric, output

Returns a Base SAS internal data descriptor handle. The handle that is generated can be used to reference the data when sending a message to a queue.

hMap

Numeric, input

Specifies a Base SAS internal map descriptor handle that is obtained from a previous MQMAP function call. If set to zero, no external defined mapping is assumed and therefore, all data is mapped according to Base SAS internal representations. That is, all numerics are mapped as doubles and all strings are mapped as character data of the current string length.

rc

Numeric, output

Provides the Base SAS return code from this function. If an error occurs, then the return code is nonzero. You can use the Base SAS function SYSMSG() to obtain a textual description of the return code.

parms

Numeric or character, input

Specifies the Base SAS variables to set.

Example

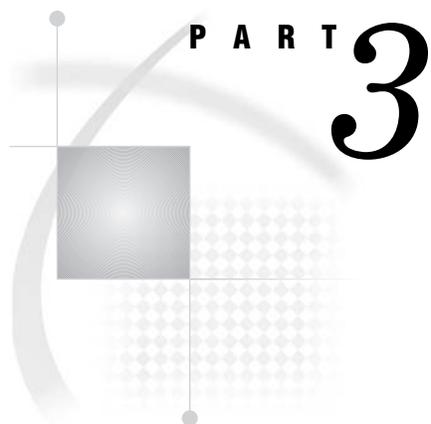
This example sets values of Base SAS variables into a message.

```

hData=0;
rc=0;
parm1=100;
parm2=9999;

```

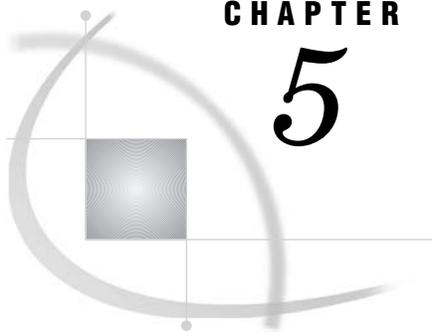
```
parm3=9999.9999;  
parm4="This is a test."  
CALL MQSETPARMS(hData, hMap, rc,  
parm1, parm2, parm3, parm4);
```



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CHAPTER

5

Using Microsoft Message Queuing Services (MSMQ)

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MSMQ Functional Interface

SAS Integration Technologies allows applications developers to combine the power of both SAS information delivery and Microsoft message queuing capabilities by providing a SAS interface to the Microsoft Message Queuing Services (MSMQ), which are part of Windows. With this interface, SAS programs can create new MSMQ message queues or use existing message queue that are available throughout the enterprise.

Writing MSMQ Applications

In MSMQ messaging, two or more applications communicate with each other indirectly and asynchronously by using message queues. The applications do not have to be running at the same time or even in the same operating environment. An application can communicate with another application by sending a message to a queue. The receiving application retrieves the message when it is ready.

A typical SAS program that uses MSMQ services performs the following tasks:

- 1 A program must first either open an existing queue or create a new queue. A function is available to help find queues based on their property values. If opening an existing queue, the program supplies a queue identifier to select the appropriate queue. If creating a new queue, a queue identifier is returned to the program to be used in subsequent calls. The queue identifier is used by MSMQ in a distributed database that maintains information about users, queues, queue managers, host machines, and network layout. This database is referred to as the MSMQ Information Store (MQIS) and helps to insulate the application developer from the details of the network.

- 2 When creating a queue, you can declare it public or private. Public queues are registered in the MQIS and can be accessed throughout the network. Private queues, on the other hand, can be accessed only by systems that know the queue's full pathname or format name. Other properties can be set when creating a queue such as security, message handling, and types of services provided by the queue. These same types of properties can also be retrieved from or set on a queue that has been opened.
- 3 A program that has opened a queue can compose and send a message. To compose a message, a function is used to identify a data map that describes the format, the number and the type of parameters to be sent as part of the message. The data map is used by a function that creates a data descriptor of the actual values of the SAS variables to be included in the message. If your distributed application uses a Microsoft Transaction Server (MTS), then a transaction object can be used to send the message based on the success of the transaction.
- 4 A program can also retrieve messages from an opened queue. MSMQ uses the concept of a cursor to identify the location of the message within a queue. A message can be read from the current cursor location, or you can see the next location. When a message is read, the program can elect to remove the message or leave it on the queue. In addition, a number of message properties such as security issues, size, identification, and statistics on the delivery can also be retrieved.
- 5 After a program has sent or retrieved all its messages, queues can also be closed or deleted. This releases the resources that were allocated when the queue was opened or created.

Note: MSMQ uses several representations to identify a queue, such as format name, pathname, instance UUID, and queue handle. There are functions available that you can use to convert between representations. Δ

MSMQ Code Samples

Introduction to the MSMQ Code Samples

This section provides examples of using the MSMQ interface with DATA step code to illustrate the semantics of sending a message to a queue and receiving the same message from the queue.

For DATA step code examples that show how to send and receive files, see “Processing a Text File” on page 113 and “Processing a Binary File” on page 119.

Note: When a SAS DATA step ends, all resources that are consumed by this DATA step are automatically freed. That is, all internal SAS handles are automatically freed. When using the SAS Macro Language to interface with MSMQ, ensure that all resources are freed programmatically. Unlike the DATA step, resources consumed by the SAS Macro Language are never implicitly freed during SAS execution. Δ

DATA Step Coding Examples

Sending a Message to a Queue

This example sends a message to a queue. Note that it assumes that the queue "respq" has been created before this example.

```

data _null_;
length rc 8;
length msg $ 200;
length Qid hQueue transobj 8;
length msgid $ 40;
length hData hMap 8;
length parm1 parm2 parm3 8;
length parm4 $ 50;

hQueue=0;
hMap=0;
hData=0;

put '----- Obtain formatname from pathname -----';
Qid=0;
rc=0;
call msmqpathtoformat("pcpad\testq", Qid, rc);
if rc ^= 0 then do;
  if rc = input('03000EC0'x, ib4.) then do;
    /* C00E0003 - MSMQ QUEUE_NOT_FOUND error */
    /* so create it... */
    put 'Queue does not exist so creating it...';
    call msmqcreatequeue(Qid, rc, "PATHNAME,LABEL",
      "pcpad\testq", "Test Queue");
    if rc ^= 0 then do;
      put 'MSMQCreateQueue: failed';
      msg = sysmsg();
      put msg;
      goto exit;
    end;
    else put 'MSMQCreateQueue: succeeded';
  end;
else do;
  put 'MSMQPathToFormat: failed';
  msg = sysmsg();
  put msg;
  goto exit;
end;
end;
else put 'MSMQPathToFormat: succeeded';

put '----- Open queue for sending -----';
call msmqopenqueue(Qid, "SEND", "SHARE", hQueue, rc);
if rc ^= 0 then do;
  put 'MSMQOpenQueue: failed';
  msg = sysmsg();

```

```

        put msg;
        goto exit;
end;
else put 'MSMQOpenQueue: succeeded';

put '----- Generate map descriptor -----';
/* data will not be aligned */
desc1="SHORT";
desc2="LONG";
desc3="DOUBLE";
desc4="CHAR,,50"; /* blank pad to 50 bytes */
call msmqmap(hMap, rc, desc1, desc2, desc3, desc4);
if rc ^= 0 then do;
    put 'MSMQMap: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;
else put 'MSMQMap: succeeded';

put '--- Generate data descriptor - actual data ---';
parm1=100;
parm2=9999;
parm3=9999.9999;
parm4="This is a test.";
call msmqsetparms(hData, hMap, rc, parm1,
    parm2, parm3, parm4);
if rc ^= 0 then do;
    put 'MSMQSetParms: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;
else put 'MSMQSetParms: succeeded';

put '----- Send message to queue -----';
transobj=0;
msgid="";
call msmqsendmsg(hQueue, hData, transobj, rc,
    "BODY_TYPE,CORRELATIONID,LABEL,MSGID,
    PRIV_LEVEL,RESP_QUEUE",
    999, "0102030405060708090A0B0C0D0E0F1011121314",
    "Secret test message", msgid,
    "PRIVATE", "pcpad\respq");
if rc ^= 0 then do;
    put 'MSMQSendMsg: failed';
    msg = sysmsg();
    put msg;
end;
else do;
    put 'MSMQSendMsg: succeeded';
end;

```

```

        /* display MSMQ-generated MSGID */
        put 'msgid is ' msgid;
    end;

exit:
if hQueue ^= 0 then do;
    put '----- Close queue -----';
    call msmqclosequeue(hQueue, rc);
    if rc ^= 0 then do;
        put 'MSMQCloseQueue: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'MSMQCloseQueue: succeeded';
end;

if Qid ^= 0 then do;
    call msmqfree(Qid);
    put 'Qid handle freed';
end;

if hMap ^= 0 then do;
    call msmqfree(hMap);
    put 'Map descriptor handle freed';
end;

if hData ^= 0 then do;
    call msmqfree(hData);
    put 'Data descriptor handle freed';
end;

run;

```

Receiving a Message from a Queue

This example receives a message from a queue.

```

data _null_;
length rc 8;
length msg $ 200;
length Qid hQueue transobj 8;
length hMap 8;
length arrivet auth size sentt 8;
length correlid msgid $ 40;
length label $ 80;
length parm1 parm2 parm3 8;
length parm4 $ 50;
length hRespQ 8;
length respq $ 80;
length respQid 8;

hQueue=0;

```

```

hMap=0;
hRespQ=0;
respQid=0;

put '----- Obtain formatname from pathname -----';
Qid=0;
rc=0;
call msmqpathtoformat("pcpad\testq", Qid, rc);
if rc ^= 0 then do;
    put 'MSMQPathToFormat: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;
else put 'MSMQPathToFormat: succeeded';

put '----- Open queue for receiving -----';
call msmqopenqueue(Qid, "RECEIVE", "SHARE", hQueue, rc);
if rc ^= 0 then do;
    put 'MSMQOpenQueue: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;
else put 'MSMQOpenQueue: succeeded';

put '-----Receive message from queue -----';
transobj=0;
hCursor=0;
call msmqreceivemsg(hQueue, 0, "RECEIVE", hCursor,
    transobj, rc, "ARRIVEDTIME,AUTHENTICATED,BODY_SIZE,
    CORRELATIONID,LABEL,MSGID,RESP_QUEUE,SENTTIME",
    arrivet, auth, size, correlid, label, msgid,
    respq, sentt);
if rc ^= 0 then do;
    put 'MSMQReceiveMsg: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;
else do;
    put 'MSMQReceiveMsg: succeeded';
    /* convert MSMQ arrived time to
       SAS datetime format */
    arrivet =
        arrivet + 10*365*24*3600 + 3*24*3600 - 5*3600;
    put 'arrived time is' arrivet datetime.;
    if auth = 1 then put 'message was authenticated';
    else put 'message was not authenticated';
    put 'message body size is ' size;
    put 'correlation id is ' correlid;
    put 'label is ' label;
end;

```

```

    put 'msg id is ' msgid;
    put 'resp_queue Qid handle is ' respq;
    /* convert MSMQ sent time to SAS datetime format */
    sentt = sentt + 10*365*24*3600 + 3*24*3600 - 5*3600;
    put 'sent time was' sentt datetime.;
end;

if size ^= 0 then do;
    put '----- Generate map descriptor -----';
    desc1="SHORT";
    desc2="LONG";
    desc3="DOUBLE";
    desc4="CHAR,,50";
    call msmqmap(hMap, rc, desc1, desc2, desc3, desc4);
    if rc ^= 0 then do;
        put 'MSMQMap: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;
    else put 'MSMQMap: succeeded';

    call msmqgetparms(hMap, rc, parm1,
        parm2, parm3, parm4);
    if rc ^= 0 then do;
        put 'MSMQGetParms: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;
    else do;
        put 'MSMQGetParms: succeeded';
        put 'parm1 = ' parm1;
        put 'parm2 = ' parm2;
        put 'parm3 = ' parm3;
        put 'parm4 = ' parm4;
    end;
end;
else put 'No data was associated with the message';

/* post a reply to the response queue if available */
if respq ^= "" then do;
    call msmqpathtoformat(respq, respQid, rc);
    if rc ^= 0 then do;
        put 'MSMQPathToFormat: failed to
            open response queue';
        msg = sysmsg();
        goto exit;
    end;

    call msmqopenqueue(respQid, "SEND",
        "SHARE", hRespQ, rc);

```

```

if rc ^= 0 then do;
  put 'MSMQOpenQueue: failed to
      open response queue';
  msg = sysmsg();
  put msg;
  goto exit;
end;

hMap=0;
call msmqsetparms(hData, hMap, rc,
  "Message received OK");
if rc ^= 0 then do;
  put 'MSMQSetParms: failed to
      send response message';
  msg = sysmsg();
  put msg;
  goto exit;
end;

transobj=0;
call msmqsendmsg(hRespQ, hData, transobj, rc);
if rc ^= 0 then do;
  put 'MSMQSendMsg: failed to
      send response message';
  msg = sysmsg();
  put msg;
end;
else put 'reply sent to the response queue';
end;

exit:
if hQueue ^= 0 then do;
  put '----- Close queue -----';
  call msmqclosequeue(hQueue, rc);
  if rc ^= 0 then do;
    put 'MSMQCloseQueue: failed';
    msg = sysmsg();
    put msg;
  end;
  else put 'MSMQCloseQueue: succeeded';
end;

if hRespQ ^= 0 then do;
  put '----- Close Response Queue -----';
  call msmqclosequeue(hRespQ, rc);
  if rc ^= 0 then do;
    put 'MSMQCloseQueue: failed to
        close response queue';
    msg = sysmsg();
    put msg;
  end;
  else put 'MSMQCloseQueue: succeeded
        to close response queue';

```

```

end;

if Qid ^= 0 then do;
    call msmqfree(Qid);
    put 'Qid handle freed';
end;

if respQid ^= 0 then do;
    call msmqfree(respQid);
    put 'respQid handle freed';
end;

if hMap ^= 0 then do;
    call msmqfree(hMap);
    put 'Map descriptor handle freed';
end;

run;

```

Processing a Text File

This example shows how to put a text file on a queue.

```

data _null_;
length rc 8;
length msg $ 200;
length Qid hQueue hmap 8;
length appspec 8;
length corrid $ 40;
length record $ 256;
length seqno 8 seqstr $ 4;

/* send this file to the queue */
infile 'd:\test.txt' length=reclen end=eof;

put '----- Obtain Formatname from Pathname -----';
call msmqpathtoformat(".\testq", Qid, rc);
if( rc ) then do;
    if( rc = input('03000EC0'x,ib4.) ) then do;
        put 'Queue does not exist so create it...';
        call msmqcreatequeue(Qid, rc, "pathname,label",
            ".\testq", "test queue");
        if( rc ) then do;
            put 'MSMQCreateQueue: failed';
            msg = sysmsg();
            put msg;
            goto exit;
        end;
    end;
else do;
    put 'MSMQPathToFormat: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

```

```

        end;
    end;

    put '----- Open Queue -----';
    call msmqopenqueue(Qid, "SEND", "SHARE", hQueue, rc);
    if( rc ) then do;
        put 'MSMQOpenQueue: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    put '----- Generate map descriptor -----';
    /* longest record in file is 255 bytes+1 length byte... */
    /* therefore all messages on the queue pertaining to */
    /* this file will be blank-padded for 256 bytes... */
    call msmqmap(hmap, rc, "char,,256");
    if rc ^= 0 then do;
        put 'MSMQMap: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    /* designate that messages belong to a text file */
    appspec=100000;

    /* all of these messages will have
       the same correlationid+seqno */
    corrid="46696c65212121"; /* File!!! */

    seqno = 0;

do until(eof);
    input @;
    input record $varying256. reclen;

    call msmqsetparms(hdata, hmap, rc, record);
    if( rc ) then do;
        put 'MSMQSetParms: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;

    /* add sequence # to correlationid */
    seqstr = put(seqno, hex4.);
    substr(corrid,15,4) = seqstr;
    seqno = seqno+1;

    put '--- Send message to queue ----';
    call msmqsendmsg(hQueue, hdata, 0, rc,
        "appspecific,correlationid", appspec, corrid);

```

```

if( rc ) then do;
  put 'MSMQSendMsg: failed';
  msg = sysmsg();
  put msg;
  goto exit;
end;

/* free data */
call msmqfree(hdata);
end;

exit:
if( hQueue ) then do;
  call msmqclosequeue(hQueue, rc);
  if( rc ) then do;
    put 'MSMQCloseQueue: failed';
    msg = sysmsg();
    put msg;
  end;
end;

if( Qid ) then
  call msmqfree(Qid);

if( hmap ) then
  call msmqfree(hmap);

stop;

run;

```

Getting a Text File from a Queue

This example shows how to receive the first text file on a queue. The appspecific parameter is equal to 100000.

```

filename output 'd:\testdup.txt';

data _null_;
length rc 8;
length msg $ 200;
length Qid hQueue hmap hCursor hCursor2 8;
length corrid corrid2 filecorrid $ 40;
length appspec 8;
length action action2 $ 12;
length record $ 256;
length seqno 8;

fileid = fopen('output', 'o', 256, 'v');
if( fileid = 0 ) then do;
  put 'Error opening output file...';
  goto exit;
end;

```

```

put '----- Obtain Formatname from Pathname -----';
call msmqpathtoformat(".\testq", Qid, rc);
if( rc ) then do;
    put 'MSMQPathToFormat: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Open Queue -----';
call msmqopenqueue(Qid, "RECEIVE", "SHARE", hQueue, rc);
if( rc ) then do;
    put 'MSMQOpenQueue: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

call msmqcreatecursor(hQueue, hCursor, rc);
if( rc ) then do;
    put 'MSMQCreateCursor failed';
    msg = sysmsg();
    put msg;
end;

/* peek first to see if belongs to the file you want */
action="PEEK_CURRENT";

seqno=0;

recv:
call msmqreceivemsg(hQueue, 0, action, hCursor, 0, rc,
    "APPSPECIFIC,CORRELATIONID", appspec, corrid);
if( rc ) then do;
    if( rc = input('1B000EC0'x,ib4.) ) then do;
        put 'reached end of queue';
        goto exit;
    end;

    put 'MSMQReceiveMsg: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

/* default action */
action="PEEK_NEXT";

if( appspec = 100000 ) then do;
    /* file processing... */
    outofseq=0;

    if( filecorrid = "" ) then do;
        /* file begins at this message */

```

```

/* write all correlating messages to this file */
filecorrid = substr(corrid,1,14);

put '----- Generate map descriptor -----';
/* all file messages were sent to the queue as
   256 bytes blank-padded */
call msmqmap(hmap, rc, "char,,256");
if( rc ) then do;
    put 'MSMQMap: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;
end;

/* make sure message belongs to this file */
if( substr(corrid,1,14) = filecorrid ) then do;
    if( seqno ^= input(substr(corrid,15,4),
        hex4.) ) then do;
        /* this message is out of sequence
           so search for it */
        outofseq=1;

        call msmqcreatecursor(hQueue, hCursor2, rc);
        if( rc ) then do;
            put 'MSMQCreateCursor failed';
            msg = sysmsg();
            put msg;
        end;

        action2="PEEK_CURRENT";
peeknxt:
        call msmqreceivemsg(hQueue, 0, action2,
            hCursor2, 0, rc, "CORRELATIONID", corrid2);
        if( rc ) then do;
            if( rc = input('1B000EC0'x,ib4.) ) then do;
                put 'Error: reached end of queue while
                    searching for out-of-sequence msg';
                goto exit;
            end;

            put 'MSMQReceiveMsg: failed';
            msg = sysmsg();
            put msg;
            goto exit;
        end;

        if( seqno ^= input(substr(corrid2,15,4),
            hex4.) ) then do;
            action2="PEEK_NEXT";
            goto peeknxt;
        end;
    end;
end;
end;

```

```

/* increment sequence number for next
   expected message */
seqno=seqno+1;

/* retrieve record from internal buffer */
call msmqgetparms(hmap, rc, record);
if( rc ) then do;
    put 'MSMQGetParms: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

put 'write record to file';
rc = fput(fileid, record);
if( rc ) then do;
    put 'Error writing to output file buffer...';
    goto exit;
end;

/* flush it to disk */
rc = fwrite(fileid);
if( rc ) then do;
    put 'Error writing to output file...';
    goto exit;
end;

/* now remove it from the queue...
   don't care about receiving body */
body=0;
if( outofseq ) then do;
    call msmqreceivmsg(hQueue, 0, "RECEIVE",
        hCursor2, 0, rc, "body", body);

    /* close this cursor */
    call msmqclosecursor(hCursor2, rc);
end;
else do;
    call msmqreceivmsg(hQueue, 0, "RECEIVE",
        hCursor, 0, rc, "body", body);
end;

/* we are now pointing at the next message */
action="PEEK_CURRENT";
end;
end;

/* finish retrieving all messages belonging
   to this file */
goto recv;

```

```

exit:
if( hQueue ) then do;
  call msmqclosequeue(hQueue, rc);
  if( rc ) then do;
    put 'MSMQCloseQueue: failed';
    msg = sysmsg();
    put msg;
  end;
end;

if( Qid ) then
  call msmqfree(Qid);

if( hmap ) then
  call msmqfree(hmap);

/* close file */
rc = fclose(fileid);
if( rc ) then put 'Error closing output file';

run;

```

Processing a Binary File

This example shows how to put a binary file on a queue. It assumes that the queue named "adminq" has been created before this.

```

data _null_;
length rc 8;
length msg $ 200;
length Qid hQueue hmap 8;
length appspec 8;
length corrid $ 40;
length msgbuf $ 256;
length seqno 8 seqstr $ 4;

/* read in as a stream of bytes */
infile 'd:\test.exe' recfm=f lrecl=1 end=eof;

put '----- Obtain Formatname from Pathname -----';
call msmqpathtoformat(".\testq", Qid, rc);
if( rc ) then do;
  if( rc = input('03000EC0'x,ib4.) ) then do;
    put 'Queue does not exist so create it';
    call msmqcreatequeue(Qid, rc, "pathname,label",
      ".\testq", "test queue:");
    if( rc ) then do;
      put 'MSMQCreateQueue: failed';
      msg = sysmsg();
      put msg;
      goto exit;
    end;
  end;
else do;

```

```

        put 'MSMQPathToFormat: failed';
        msg = sysmsg();
        put msg;
        goto exit;
    end;
end;

put '----- Open Queue -----';
call msmqopenqueue(Qid, "SEND", "SHARE", hQueue, rc);
if( rc ) then do;
    put 'MSMQOpenQueue: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Generate map descriptor -----';
/* send 256 byte messages to the queue */
call msmqmap(hmap, rc, "char,,256");
if( rc ) then do;
    put 'MSMQMap: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

/* designate messages belong to a binary file */
appspec=100001;

/* all of these messages will have the
   same correlationid */
corrid="42696e46696c65212121"; /* BinFile!!! */

seqno = 0;

i=1;
do until(eof);
    /* read a byte at a time */
    input x $char1.;
    i+1;
    substr(msgbuf,i,1) = x;
    if i = 256 or eof then do;
        /* set length of this record embedded
           as first byte of message */
        substr(msgbuf,1,1) = put(i-1,pib1.);

        call msmqsetparms(hdata, hmap, rc, msgbuf);
        if( rc ) then do;
            put 'MSMQSetParms: failed';
            msg = sysmsg();
            put msg;
            goto exit;
        end;
    end;
end;

```

```

/* add sequence # to correlationid */
seqstr = put(seqno, hex4.);
substr(corrid,21,4) = seqstr;
seqno = seqno + 1;

put '--- Send message to queue ----';
call msmqsendmsg(hQueue, hdata, 0, rc,
  "appspecific,correlationid,acknowledge,
  admin_queue", appspec, corrid,
  "nack_reach_queue", ".\adminq");
if( rc ) then do;
  put 'MSMQSendMsg: failed';
  msg = sysmsg();
  put msg;
  goto exit;
end;

/* free data */
call msmqfree(hdata);

/* reset message buffer entities */
i=1;
msgbuf="";

end;
end;

exit:
if( hQueue ) then do;
  call msmqclosequeue(hQueue, rc);
  if( rc ) then do;
    put 'MSMQCloseQueue: failed';
    msg = sysmsg();
    put msg;
  end;
end;

if( Qid ) then
  call msmqfree(Qid);

if( hmap ) then
  call msmqfree(hmap);

stop;

run;

```

Getting a Binary File from a Queue

This example shows how to receive the first binary file on a queue.

```

filename output 'd:\testdup.exe';

data _null_;

```

```

length rc 8;
length msg $ 200;
length Qid hQueue hmap hCursor hCursor2 8;
length corrid corrid2 filecorrid $ 40;
length appspec 8;
length action action2 $ 12;
length msgbuf stream $ 256;
length len 8;
length seqno 8;

fileid = fopen('output', 'o', 0, 'b');
if( fileid = 0 ) then do;
    put 'Error opening output file...';
    goto exit;
end;

put '----- Obtain Formatname from Pathname -----';
call msmqpathtoformat(".\testq", Qid, rc);
if( rc ) then do;
    put 'MSMQPathToFormat: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

put '----- Open Queue -----';
call msmqopenqueue(Qid, "RECEIVE", "SHARE", hQueue, rc);
if( rc ) then do;
    put 'MSMQOpenQueue: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

call msmqcreatecursor(hQueue, hCursor, rc);
if( rc ) then do;
    put 'MSMQCreateCursor failed';
    msg = sysmsg();
    put msg;
end;

/* peek first to see if belongs to the file you want */
action="PEEK_CURRENT";

seqno=0;

recv:
call msmqreceivemsg(hQueue, 0, action, hCursor, 0, rc,
    "APPSPECIFIC,CORRELATIONID", appspec, corrid);
if( rc ) then do;
if( rc = input('1B00EC0'x,ib4.) ) then do;
    put 'reached end of queue';
    goto exit;
end;
end;

```

```

    put 'MSMQReceiveMsg: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

/* default action */
action="PEEK_NEXT";

if( appspec = 100001 ) then do;
    /* file processing */
    outofseq=0;

    if( filecorrid = "" ) then do;
        /* file begins at this message */

        /* write all correlating messages to this file */
        filecorrid = substr(corrid,1,20);

        put '----- Generate map descriptor -----';
        /* all file messages were sent to the queue as
           256 bytes blank-padded */
        call msmqmap(hmap, rc, "char,,256");
        if( rc ) then do;
            put 'MSMQMap: failed';
            msg = sysmsg();
            put msg;
            goto exit;
        end;
    end;

    /* make sure message belongs to this file */
    if( substr(corrid,1,20) = filecorrid ) then do;
        if( seqno ^= input(substr(corrid,21,4), hex4.) )
            then do;
            /* this message is out of sequence
               so search for it */
            outofseq=1;

            call msmqcreatecursor(hQueue, hCursor2, rc);
            if( rc ) then do;
                put 'MSMQCreateCursor failed';
                msg = sysmsg();
                put msg;
                goto exit;
            end;

            action2="PEEK_CURRENT";
peeknxt:
            call msmqreceivemsg(hQueue, 0, action2,
                hCursor2, 0, rc, "CORRELATIONID", corrid2);
            if( rc ) then do;
                if( rc = input('1B00EC0'x, ib4.) ) then do;

```

```

        put 'Error: reached end of queue while
           searching for out-of-sequence msg';
        goto exit;
    end;

    put 'MSMQReceiveMsg: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

if( seqno ^= input(substr(corrid2,21,4), hex4.) )
    then do;
        action2="PEEK_NEXT";
        goto peeknxt;
    end;
end;

/* increment sequence number for
   next expected message */
seqno=seqno+1;

/* retrieve record from internal buffer */
call msmqgetparms(hmap, rc, msgbuf);
if( rc ) then do;
    put 'MSMQGetParms: failed';
    msg = sysmsg();
    put msg;
    goto exit;
end;

/* length of this stream is embedded
   as 1st byte in msg */
len = input(substr(msgbuf,1,1), pib1.);
stream = substr(msgbuf,2);

put 'write stream to file';
rc = fput(fileid, substr(stream,1,len));
if( rc ) then do;
    put 'Error writing to output file buffer...';
    goto exit;
end;

/* flush it to disk */
rc = fwrite(fileid);
if( rc ) then do;
    put 'Error writing to output file...';
    goto exit;
end;

/* now remove it from the queue...
   don't care about receiving body */
body=0;

```

```

if( outofseq ) then do;
    call msmgreceivmsg(hQueue, 0, "RECEIVE",
        hCursor2, 0, rc, "body", body);

    /* close this cursor */
    call msmqclosecursor(hCursor2, rc);
end;
else do;
    call msmgreceivmsg(hQueue, 0, "RECEIVE",
        hCursor, 0, rc, "body", body);
end;

/* we are now pointing at the next message */
action="PEEK_CURRENT";
end;
end;

/* finish retrieving all messages belonging
to this file */
goto recv;

exit:
if( hQueue ) then do;
    call msmqclosequeue(hQueue, rc);
    if( rc ) then do;
        put 'MSMQCloseQueue: failed';
        msg = sysmsg();
        put msg;
    end;
end;

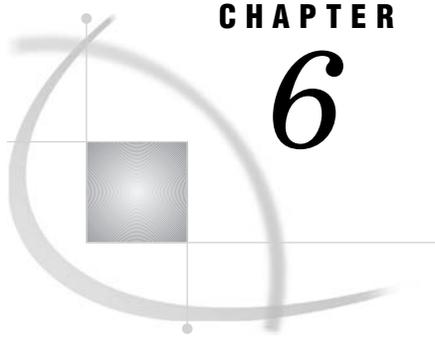
if( Qid ) then
    call msmqfree(Qid);

if( hmap ) then
    call msmqfree(hmap);

/* close file */
rc = fclose(fileid);
if( rc ) then put 'Error closing output file';

run;

```

CHAPTER

6

MSMQ Call Routines

Overview of MSMQ Call Routines 127

Overview of MSMQ Call Routines

Integration Technologies supports a set of SAS CALL routines that interface directly with the MSMQ API. This section documents those CALL routines.

MSMQABORTTRANS

Cancels a unit of work from an MSMQ transaction.

Syntax

```
CALL MSMQABORTTRANS(transObj, rc);
```

Arguments

transObj

Numeric, input

Specifies the transaction object that is obtained from a previous MSMQBEGINTRANS function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example cancels a unit of work from an MSMQ transaction.

```

length msg $ 200;
rc=0;
CALL MSMQABORTTRANS(transobj, rc);
if rc ^= 0 then do;
  put 'MSMQAbortTrans: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQAbortTrans: succeeded';

```

MSMQBEGINTRANS

Creates an internal MSMQ transaction object that can be used to send messages to a queue or read messages from a queue.

Syntax

```
CALL MSMQBEGINTRANS(transObj, rc);
```

Arguments

transObj

Numeric, output
Returns the transaction object.

rc

Numeric, output
Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example creates a transaction object.

```

length msg $ 200;
transobj=0;
rc=0;
CALL MSMQBEGINTRANS(transobj, rc);
if rc ^= 0 then do;
  put 'MSMQBeginTrans: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQBeginTrans: succeeded';

```

MSMQCREATEQUEUE

Creates a queue at a specified MSMQ pathname.

Syntax

```
CALL MSMQCREATEQUEUE(qid, rc, propids, value1 <value2, ...>);
```

Arguments

qid

Numeric, output

Returns the queue identifier that represents the format name of the queue that is created. The format name of the queue is a unique name generated by MSMQ.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

propids

Character, input

Specifies one or more properties that the queue exhibits when it is created. This parameter is a character string with each applicable property separated by a comma. PATHNAME is the only required property. You must provide a *value* parameter for each property specified in the *propids* string. Each property ID in the *propids* string is associated positionally with a *value* parameter.

The following creation properties are valid:

AUTHENTICATE

Specifies whether the queue accepts only authenticated messages. The following values are valid:

NONE (default)

Specifies the queue accepts either authenticated or non-authenticated messages.

ALWAYS

Specifies the queue always requires authenticated messages.

BASEPRIORITY

Specifies a single base priority for all messages that are sent to a public queue. Values range from -32768 to 32767, where 32767 is the highest priority and 0 is the default priority.

JOURNAL

Determines whether messages retrieved from the queue are also copied to its journal queue. The following values are valid:

NONE (default)

Specifies that messages that are removed from the queue are discarded.

ALWAYS

Specifies that messages removed from the queue are always stored in its journal queue.

JOURNAL_QUOTA

Specifies the maximum size (in kilobytes) of the journal queue. The default size is infinite.

LABEL

Describes the queue. The default is a blank label ().

PATHNAME

Specifies the MSMQ pathname of the queue. The format of a public queue is:

```
MachineName\QueueName
```

The format of a private queue is:

```
MachineName\PRIVATE$\QueueName
```

PRIV_LEVEL

Specifies the privacy level that is required by the queue. The following values are valid:

NONE

Specifies that the queue accepts only non-private (clear) messages.

BODY

Specifies that the queue accepts only private (encrypted) messages.

OPTIONAL (default)

Specifies that the queue accepts both private and non-private messages.

QUOTA

Specifies the maximum size (in kilobytes) of the queue. The default size is infinite.

TRANSACTION

Specifies whether the queue is a transaction queue or a non-transaction queue. The following values are valid:

NONE (default)

Specifies that the queue does not accept transaction operations.

ALWAYS

Specifies that all messages that are sent to the queue must always be done through an MSMQ transaction.

TYPE

Specifies the type of service that is provided by the queue. The value of the TYPE property is a universal unique identifier (UUID) in the form of a character string that represents the binary data.

Note: Security of the queue defaults as follows: △

- Owner: process user
- Group: process group
- DACL: queue creator - has full control
- Queue users
 - get queue properties
 - get queue security
 - send messages

These defaults can either be changed programmatically by using the MSMQSETQSEC routine or via the MSMQ Explorer interface.

Details

The routine also registers the queue in the MSMQ Information Store (MQIS) for public queues or registers it on the local computer for private queues.

Example

This example creates a public queue.

```
length msg $ 200;
qid=0;
rc=0;
CALL MSMQCREATEQUEUE(qid, rc, 'PATHNAME,LABEL', 'pcpad\testq', 'Test Queue');
if rc ^= 0 then do;
  put 'MSMQCreateQueue: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQCreateQueue: succeeded';
```

MSMQCLOSECURSOR

Closes a given cursor thereby allowing MSMQ to release the associated resources.

Syntax

```
CALL MSMQCLOSECURSOR(hCursor, rc);
```

Arguments

hCursor

Numeric, input

Specifies the handle to a cursor that is used for looking at messages in the queue. The MSMQCREATECURSOR routine is used to create a cursor and obtain its handle.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example closes a cursor.

```
length msg $ 200;
rc=0;
CALL MSMQCLOSECURSOR(hCursor, rc);
if rc ^= 0 then do;
  put 'MSMQCloseCursor: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQCloseCursor: succeeded';
```

MSMQCLOSEQUEUE

Closes a given queue.

Syntax

```
CALL MSMQCLOSEQUEUE(hQueue, rc);
```

Arguments

hQueue

Numeric, input

Specifies the MSMQ handle to an open queue. This parameter is obtained from a previous MSMQOPENQUEUE function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise,

it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example closes a queue.

```
length msg $ 200;
rc=0;
CALL MSMQCLOSEQUEUE(hQueue, rc);
if rc ^= 0 then do;
  put 'MSMQCloseQueue: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQCloseQueue: succeeded';
```

MSMQCOMMITTRANS

Commits a unit of work from an MSMQ transaction.

Syntax

```
CALL MSMQCOMMITTRANS(transObj, rc);
```

Arguments

transObj

Numeric, input

Specifies the transaction object that is obtained from a previous MSMQBEGINTRANS function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example commits a unit of work from an MSMQ transaction.

```
length msg $ 200;
rc=0;
CALL MSMQCOMMITTRANS(transobj, rc);
if rc ^= 0 then do;
  put 'MSMQCommitTrans: failed';
  msg = sysmsg();
```

```

        put msg;
    end;
else put 'MSMQCommitTrans: succeeded';

```

MSMQCREATECURSOR

Creates a cursor that is used to maintain a specific location in a queue when reading its messages.

Syntax

```
CALL MSMQCREATECURSOR(hQueue, hCursor, rc);
```

Arguments

hQueue

Numeric, input

Specifies the MSMQ handle to an open queue. This parameter is obtained from a previous MSMQOPENQUEUE function call.

hCursor

Numeric, output

Returns the handle of the cursor that is used for looking at messages in the queue. The MSMQCREATECURSOR routine is used to create a cursor and obtain its handle.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example creates a cursor.

```

length msg $ 200;
hCursor=0;
rc=0;
CALL MSMQCREATECURSOR(hQueue, hCursor, rc);
if rc ^= 0 then do;
    put 'MSMQCreateCursor: failed';
    msg = sysmsg();
    put msg;
end;
else put 'MSMQCreateCursor: succeeded';

```

MSMQDELETEQUEUE

Deletes a queue from the MQIS in the case of public queues, or from the local computer in the case of private queues.

Syntax

```
CALL MSMQDELETEQUEUE(qid, rc);
```

Arguments

qid

Numeric, input

Specifies the queue identifier that represents the format name of the queue to be deleted.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example deletes a queue.

```
length msg $ 200;
rc=0;
CALL MSMQDELETEQUEUE(qid, rc);
if rc ^= 0 then do;
  put 'MSMQDeleteQueue: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQDeleteQueue: succeeded';
```

MSMQFREE

Frees a SAS internal handle, thereby releasing its resources.

Syntax

```
CALL MSMQFREE(handle);
```

Arguments

handle

Numeric, input

Specifies a SAS internal handle that is obtained from a previous CALL routine. The following CALL routines return handles that can be used as input to this routine (the type of handle is also shown after the CALL routine name):

- MSMQCREATEQUEUE - qid (format name representation)
- MSMQPATHTOFORMAT - qid
- MSMQINSTTOFORMAT - qid
- MSMQHNDLTOFORMAT - qid
- MSMQMAP - hMap
- MSMQSETPARMS - hData

Example

This example frees a handle and its resources.

```
CALL MSMQFREE(Handle);
```

MSMQFREESCONTEXT

Frees the memory that is allocated by MSMQGETSCONTEXT.

Syntax

```
CALL MSMQFREESCONTEXT(hContext, rc);
```

Arguments

hContext

Numeric, input

Specifies the handle to the security context buffer that is allocated by MSMQ.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example frees the security context buffer.

```
length msg $ 200;
rc=0;
```

```

CALL MSMQFREESCONTEXT(hContext, rc);
if rc ^= 0 then do;
    put 'MSMQFreeSContext: failed';
    msg = sysmsg();
    put msg;
end;
else put 'MSMQFreeSContext: succeeded';

```

MSMQGETPARMS

Retrieves values of SAS variables from a previous MSMQ message that was received by an MSMQRECEIVMSG call.

Syntax

```
CALL MSMQGETPARMS(hMap, rc, parm1 <,parm2, parm3, ...>);
```

Arguments

hMap

Numeric, input

Specifies the SAS internal map descriptor handle that is obtained from a previous MSMQMAP function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

parms

Numeric or character, input

Specifies one or more parameters that are used to define the values of SAS variables in a message. Initialize the variables appropriately to guarantee that truncation of the returned values does not occur.

Details

This message is available until the next MSMQRECEIVMSG call is performed.

Example

This example gets values of SAS variables from a received message.

```

length parm1 parm2 parm3;
length parm4 $ 200;
rc=0;
CALL MSMQGETPARMS(hMap, rc, parm1, parm2, parm3, parm4);

```

MSMQGETQPROP

Retrieves properties for a specific queue.

Syntax

```
CALL MSMQGETQPROP(qid, rc, propids, value1 <,value2, ...>);
```

Arguments

qid

Numeric, input

Specifies the queue identifier that represents the format name of the queue.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

propids

Character, input

Identifies one or more properties that you want to retrieve. This parameter is a character string with each applicable property separated by a comma. For each property identified by *propids*, you must provide a *value* parameter that specifies a variable name to use to hold the returned property value.

The following *propids* and *values* are valid:

AUTHENTICATE

Retrieves whether the queue accepts only authenticated messages. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

NONE

Specifies the queue accepts either authenticated or non-authenticated messages.

ALWAYS

Specifies the queue always requires authenticated messages.

BASEPRIORITY

Retrieves the base priority for all messages that are sent to a public queue. The value is a numeric that ranges from -32768 to 32767, where 32767 is the highest priority and 0 is the default priority.

CREATE_TIME

Retrieves the time and date when the queue was created. The value is a numeric that represents the number of seconds elapsed since midnight (00:00:00), January 1, 1970 (Coordinated Universal time).

INSTANCE

Retrieves the queue's identifier (UUID). The value is a character string that represents binary data. Initialize the variable appropriately to guarantee that truncation of the returned value does not occur.

JOURNAL

Retrieves if messages are also copied to its journal queue. Initialize the variable to a size of at least 32 to guarantee that truncation of the returned value does not occur. The following values are valid:

NONE

Specifies that messages removed from the queue are discarded.

ALWAYS

Specifies that messages removed from the queue are always stored in its journal queue.

JOURNAL_QUOTA

Retrieves the maximum size (in kilobytes) of the journal queue.

LABEL

Retrieves a description of the queue. The value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring.

MODIFY_TIME

Retrieves the last time the queue's properties were modified. The value is a numeric that represents the number of seconds elapsed since midnight (00:00:00), January 1, 1970 (Coordinated Universal time).

PATHNAME

Retrieves the MSMQ pathname of the queue. The value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring.

PRIV_LEVEL

Retrieves the privacy level that is required by the queue. The value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

NONE

Specifies that the queue accepts only non-private (clear-text) messages.

BODY

Specifies that the queue accepts only private (encrypted) messages.

OPTIONAL

Specifies that the queue accepts both private and non-private messages.

QUOTA

Retrieves the maximum size (in kilobytes) of the queue.

TRANSACTION

Retrieves whether the queue uses MQMQ transactions. The value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

NONE

Specifies that the queue does not accept transaction operations.

ALWAYS

Specifies that all messages that are sent to the queue must always be done through an MSMQ transaction.

TYPE

Retrieves the type of service that is provided by the queue. The value of the **TYPE** property is a universal unique identifier (UUID) in the form of a character string that represents the binary data. Initialize the variable to a size of at least 32 to guarantee that truncation of the returned value does not occur.

Example

This example gets the queue properties and displays them.

```

length msg $ 200;
length base createt jquota modifyt quota 8;
length auth journal priv trans $ 10;
length inst type $ 32;
length label path $ 80;
rc=0;
CALL MSMQGETQPROP(qid, rc, "AUTHENTICATE,BASEPRIORITY,CREATE_TIME,INSTANCE,JOURNAL,
                        JOURNAL_QUOTA,LABEL,MODIFY_TIME,PATHNAME,PRIV_LEVEL,
                        QUOTA,TRANSACTION,TYPE",
                        auth, base, createt, inst, journal, jquota, label,
                        modifyt, path, priv, quota, trans, type);

if rc ^= 0 then do;
  put 'MSMQGetQProp: failed';
  msg = sysmsg();
  put msg;
end;
else do;
  put 'MSMQGetQProp: succeeded';
  put 'authenticate is ' auth;
  put 'base priority is ' base;
  /* convert MSMQ create time to SAS datetime format */
  createt = createt + 10*365*24*3600 + 3*24*3600 - 5*3600;
  put 'create time was ' createt datetime.;
  put 'instance identifier is ' inst;
  put 'journal enablement is ' journal;
  put 'journal quota is ' jquota;
  put 'label is ' label;
  /* convert MSMQ modify time to SAS datetime format */
  modifyt = modifyt + 10*365*24*3600 + 3*24*3600 - 5*3600;
  put 'last modification time was ' modifyt datetime.;
  put 'pathname is ' path;
  put 'privacy level is ' priv;
  put 'quota is ' quota;
  put 'transaction requirement is ' trans;
  put 'type of service is ' type;
end;

```

MSMQGETQSEC

Retrieves the access control security information for the specified queue.

Syntax

```
CALL MSMQGETQSEC(qid, rc, owner, dacl);
```

Arguments

qid

Numeric, input

Specifies the queue identifier that represents the format name of the queue.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

owner

Character, output

Returns the owner of the queue. Initialize this variable appropriately to guarantee that truncation of the returned value does not occur.

dacl

Character, output

Returns the discretionary access control list for the queue. Initialize this variable appropriately to guarantee that truncation of the returned value does not occur. This parameter is returned in the form of

```
Domain\Account:accessType:Permissions,...
```

where *accessType* is one of the following:

- ALLOW (Permissions allowed)
- DENY (Permissions denied)

Permissions is one or more of the following separated by '+':

- Rj (Receive Journal)
- Rq (Receive Message)
- Pq (Peek Message)
- Sq (Send Message)
- Sp (Set Properties)
- Gp (Get Properties)
- D (Delete Queue)
- Pg (Get Permissions)
- Ps (Set Permissions)
- O (Take Ownership)

Example

This example gets the queue security properties and displays them.

```
length msg $ 200;
length owner $ 60;
length dacl $ 200;
rc=0;
CALL MSMQGETQSEC(qid, rc, owner, dacl);
if rc ^= 0 then do;
  put 'MSMQGetQSec: failed';
```

```

    msg = sysmsg();
    put msg;
end;
else do;
    put 'MSMQGetQSec: succeeded';
    put 'owner is ' owner;
    put 'dacl is ' dacl;
end;

```

MSMQGETSCONTEXT

Retrieves security information that is needed to authenticate messages.

Syntax

CALL MSMQGETSCONTEXT(*certStor*, *hContext*, *rc*);

Arguments

certStor

Character, input

Specifies the name of the system certificate store to use to locate the desired external certificate. If NULL, then the internal security certificate that is provided by MSMQ is used. Generally, MY is used. The corresponding registry entry is:

```
HKEY_CURRENTUSER\Software\Microsoft\SystemCertificates\MY\Certificates
```

hContext

Numeric, output

Returns a handle to the security context buffer that is allocated by MSMQ.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example gets the security context from internal MSMQ certificate.

```

length msg $ 200;
hContext=0;
rc=0;
CALL MSMQGETSCONTEXT('','', hContext, rc);
if rc ^= 0 then do;
    put 'MSMQGetSContext: failed';
    msg = sysmsg();
    put msg;

```

```

end;
else put 'MSMQGetSContext: succeeded';

```

MSMQHNDLTOFORMAT

Returns a queue identifier that represents a format name based on its open handle.

Syntax

```
CALL MSMQHNDLTOFORMAT(hQueue, qid, rc);
```

Arguments

hQueue

Numeric, input

Specifies the MSMQ handle to an open queue. This parameter is obtained from a previous MSMQOPENQUEUE function call.

qid

Numeric, output

Returns the queue identifier that represents the format name of the queue.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example obtains the format name of a queue from a queue handle.

```

length msg $ 200;
qid=0;
rc=0;
CALL MSMQHNDLTOFORMAT(hQueue, qid, rc);
if rc ^= 0 then do;
  put 'MSMQHndlToFormat: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQHndlToFormat: succeeded';

```

MSMQINSTTOFORMAT

Returns a queue identifier that represents a format name based on the instance identifier provided.

Syntax

```
CALL MSMQINSTTOFORMAT(instance, qid, rc);
```

Arguments

instance

Character, input

Specifies the universal unique identifier (UUID) instance of the queue.

qid

Numeric, output

Returns the queue identifier that represents the format name of the queue.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example obtains the format name of a queue from an instance UUID.

```
length msg $ 200;
qid=0;
rc=0;
CALL MSMQINSTTOFORMAT(guid, qid, rc);
if rc ^= 0 then do;
  put 'MSMQInstToFormat: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQInstToFormat: succeeded';
```

MSMQLOCATE

Provides a means of locating a single public queue (or set of public queues) based on a set of criteria.

Syntax

```
CALL MSMQLOCATE(criteria, sortpref, rc, cProps, propids, value1 <,value2, ...>);
```

Arguments

criteria

Character, input

Identifies the criteria to use for locating the queue or queues. The criteria are based on a queue's properties and each property's value. The *criteria* parameter uses the following format:

```
propid:op:value, ...
```

where *propid* is a queue property, *value* is the *propid* value, and *op* is an operator used as the selection criteria. The *op* parameter can be:

- LT (Less than)
- LE (Less than or equal)
- EQ (Equal)
- NE (Not equal)
- GE (Greater than or equal)
- GT (Greater than)

sortpref

Character, input

Specifies the queue sorting preference. This parameter uses the following format:

```
propid:order, ...
```

where *propid* is a queue property, and *order* is the order preference. The order parameter can be specified as:

- ASCEND (Ascending order)
- DESCEND (Descending order)

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

cProps

Numeric, output

Returns the number of property values that resulted from the criteria search.

propids

Character, input

Identifies one or more properties that you want to retrieve. This parameter is a character string with each applicable property separated by a comma.

Note: The number of *values* specified should be a multiple of *propids* specified. For example, if you specified two *propids* and wanted to retrieve these properties for the first three queues that meet the specified criteria, you must specify six (3x2) *value* parameters in order to retrieve these property values for all of the queues. △

The following *propids* and *values* are valid:

AUTHENTICATE

Retrieves whether the queue accepts only authenticated messages. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

NONE

Specifies the queue accepts either authenticated or non-authenticated messages.

ALWAYS

Specifies the queue always requires authenticated messages.

BASEPRIORITY

Retrieves the base priority for all messages that are sent to a public queue. The value is a numeric that ranges from -32768 to 32767, where 32767 is the highest priority and 0 is the default priority.

CREATE_TIME

Retrieves the time and date when the queue was created. The value is a numeric that represents the number of seconds elapsed since midnight (00:00:00), January 1, 1970 (Coordinated Universal time).

INSTANCE

Retrieves the queue's identifier (UUID). The value is a character string that represents binary data. Initialize the variable to a size of at least 32 to guarantee that truncation of the returned value does not occur.

JOURNAL

Queries whether messages are also copied to its journal queue. Initialize the variable to a size of at least 32 to guarantee that truncation of the returned value does not occur. The following values are valid:

NONE

Specifies that messages removed from the queue are discarded.

ALWAYS

Specifies that messages removed from the queue are always stored in its journal queue.

JOURNAL_QUOTA

Retrieves the maximum size (in kilobytes) of the journal queue.

LABEL

Retrieves a description of the queue. The value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring.

PATHNAME

Retrieves the MSMQ pathname of the queue. The value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring.

PRIV_LEVEL

Retrieves the privacy level that is required by the queue. The value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

NONE

Specifies that the queue accepts only non-private (clear-text) messages.

BODY

Specifies that the queue accepts only private (encrypted) messages.

OPTIONAL

Specifies that the queue accepts both private and non-private messages.

QUOTA

Retrieves the maximum size (in kilobytes) of the queue.

TRANSACTION

Retrieves whether the queue uses MSMQ transactions. The value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

NONE

Specifies that the queue does not accept transaction operations.

ALWAYS

Specifies that all messages that are sent to the queue must always be done through an MSMQ transaction.

TYPE

Retrieves the type of service that is provided by the queue. The value of the TYPE property is a universal unique identifier (UUID) in the form of a character string that represents the binary data. Initialize the variable to a size of at least 32 to guarantee that truncation of the returned value does not occur.

Example

This example locates the first three queues with a label Test Queue and returns AUTHENTICATE, PRIV_LEVEL, and PATHNAME properties.

```
length msg $ 200;
length cProps 8;
length auth1 auth2 auth3 priv1 priv2 priv3 $ 10;
length path1 path2 path3 $ 80;
rc=0;
cProps=0;
CALL MSMQLOCATE("LABEL:EQ:Test Queue", "", rc, cProps,
                "AUTHENTICATE,PRIV_LEVEL,PATHNAME",
                auth1, priv1, path1, auth2, priv2, path2, auth3, priv3, path3);
if rc ^= 0 then do;
  put 'MSMQLocate: failed';
  msg = sysmsg();
  put msg;
end;
else do;
  put 'MSMQLocate: succeeded';
  if cProps = 0 then put 'no queues were found';
  else do;
    cProps = cProps/3; /* # queues */
    if cProps GE 1 then do;
      put 'queue 1 - authenticate is ' auth1;
      put 'queue 1 - privacy is ' priv1;
      put 'queue 1 - pathname is ' path1;
    end;
    if cProps GE 2 then do;
      put 'queue 2 - authenticate is ' auth2;
      put 'queue 2 - privacy is ' priv2;
      put 'queue 2 - pathname is ' path2;
    end;
  end;
end;
```

```

if cProps EQ 3 then do;
    put 'queue 3 - authenticate is ' auth3;
    put 'queue 3 - privacy is ' priv3;
    put 'queue 3 - pathname is ' path3;
end;
end;

```

MSMQMAP

Defines a data map that can be subsequently used on an MSMQSETPARMS or MSMQGETPARMS call.

Syntax

```
CALL MSMQMAP(hMap, rc, desc1 <,desc2, desc3, ...>);
```

Arguments

hMap

Numeric, output

Returns the SAS internally generated map descriptor handle.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

descs

Character, input

Specifies descriptor parameters that are used to describe the different data types in a map. Each description (*desc1*, *desc2*, ...) defines the data type, an offset from the beginning of the message, and the length of the data. A descriptor has the following format:

```
TYPE< ,OFFSET,LENGTH>
```

where:

TYPE is one of the following:

- CHAR (Character data)
- SHORT (Short binary)
- LONG (Long binary)
- DOUBLE (Floating point double)

OFFSET

Specifies the offset from the beginning of the message. This property is optional, so by default the data is not aligned (data starts at next available position in message).

LENGTH

Specifies the length of the data being represented. This property is optional in most cases. The only time length is required is when setting up to receive character data. Specifying length for numeric data is ignored because length is implicitly defined.

Note: Type coercion is performed transparently when you put SAS variables into an MSMQ message (MSMQSETPARMS) and also when you get SAS variables from an MSMQ message (MSMQGETPARMS). That is, if the data that you are sending or receiving is a different type than the SAS variable itself, then the data is coerced into the appropriate data type. △

Example

This example defines a map to use to send and receive a message with a short, a long, a double, and a character string. No alignment is specified for any data type, and strings will always be 200 characters in length (blank padded).

```
hMap=0;
rc=0;
desc1='SHORT';
desc2='LONG';
desc3='DOUBLE';
desc4='CHAR,,200';
CALL MSMQMAP(hMap, rc, desc1, desc2, desc3, desc4);
```

MSMQOPENQUEUE

Opens a queue for sending message to the queue or for reading its messages.

Syntax

```
CALL MSMQOPENQUEUE(qid, access, shareMode, hQueue, rc);
```

Arguments***qid***

Numeric, input

Specifies the queue identifier that represents the format name of the queue to be opened.

access

Character, input

Indicates the level of access that users have to the messages in the queue being opened. The following values are valid:

PEEK

Specifies that messages can only be looked at.

SEND

Specifies that messages can only be sent to the queue.

RECEIVE

Specifies that messages can be looked at and removed from the queue.

shareMode

Character, input

Specifies how the queue is shared. The following values are valid:

SHARE

Specifies that the queue is available to everyone.

DENY_SHARE

Specifies that the process making this function call is the only one that can receive messages from this queue. If the queue is already opened for receiving messages by another process, then this call will fail.

hQueue

Numeric, output

Returns the MSMQ handle of the opened queue. This handle is used by subsequent CALL routines to identify and access the queue.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example opens a queue for sending messages.

```
length msg $ 200;
hQueue=0;
rc=0;
CALL MSMQOPENQUEUE(qid, 'SEND', 'SHARE', hQueue, rc);
if rc ^= 0 then do;
  put 'MSMQOpenQueue: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQOpenQueue: succeeded';
```

MSMQPATHTOFORMAT

Returns a queue identifier (qid) handle that represents the format name of the desired queue.

Syntax

CALL MSMQPATHTOFORMAT(*pathName*, *qid*, *rc*);

Arguments

pathName

Character, input

Represents the queue's pathname or actual format name of the queue, if known. If an MSMQ pathname is used to represent the queue, then it is converted to an MSMQ format name. Possible *pathName* representations are as follows:

- Public queue: *machineName\QueueName*
- Public queue's journal: *machineName\QueueName;Journal*
- Private queue: *machineName\PRIVATE\$QueueName*
- Private queue's journal: *machineName\PRIVATE\$QueueName;Journal*
- Machine journal queue: *machineName\JOURNAL*
- Machine deadletter queue: *machineName\DEADLETTER*
- Machine transaction deadletter queue: *machineName\DEADXACT*

Note: *machineName* can be substituted with '.' to designate the local machine. If the actual format name of the queue is known, then this call can be used to transform it into the expected unicode string. △

Possible format name representations are as follows:

- Public queue: *public=QueueGUID*
- Public queue's journal: *public=QueueGUID;JOURNAL*
- Private queue: *private=machineGUID\QueueNumber*
- Private queue's journal: *private=machineGUID\QueueNumber;JOURNAL*
- Direct public queue: *direct=AddressSpec\QueueName*
- Direct private queue: *direct=AddressSpec\PRIVATE\$QueueName*
where *AddressSpec* is of the form protocol:address (For example, tcp:10.26.1.177)
- Machine journal queue: *machine=machineGUID;JOURNAL*
- Machine deadletter queue: *machine=machineGUID;DEADLETTER*
- Machine transaction deadletter queue: *machine=machineGUID;DEADXACT*
- Foreign queue: *connector=ForeignCNGUID*
- Foreign transaction queue: *connector=ForeignCNGUID:XACTONLY*

qid

Numeric, output

Returns the queue identifier that represents the format name of the queue.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example obtains the format name of a queue from the pathname.

```
length msg $ 200;
qid=0;
rc=0;
```

```

CALL MSMQPATHTOFORMAT('pcpad\testq', qid, rc);
if rc ^= 0 then do;
    put 'MSMQPathToFormat: failed';
    msg = sysmsg();
    put msg;
end;
else put 'MSMQPathToFormat: succeeded';

```

MSMQRECEIVMSG

Reads a message from the queue.

Syntax

```
CALL MSMQRECEIVMSG(hQueue, timeout, action, hCursor, transObj, rc <, propids,
    value1, value2, ...>);
```

Arguments

hQueue

Numeric, input

Specifies the MSMQ handle to an open queue. This parameter is obtained from a previous MSMQOPENQUEUE function call.

timeout

Numeric, input

Specifies the amount of time (in milliseconds) to wait for a message to be received from the queue. If you want to wait indefinitely for the message to be received, then set the timeout parameter to -1.

action

Character, input

Determines how and where the message is read from the queue. This parameter is also used to determine whether the message is removed after reading. Possible valid values:

RECEIVE

Reads the message at the current cursor location and removes it from the queue.

PEEK_CURRENT

Reads a message at the current cursor location but does not remove it from the queue. The cursor remains at the current message. If the *hCursor* parameter is 0, then the queue's cursor can point only to the first message in the queue.

PEEK_NEXT

Reads the next message in the queue (skipping the message at the current cursor location) but does not remove it from the queue. A cursor must already be created (by calling MSMQCREATECURSOR) before calling this routine. (*hCursor* = 0 is not allowed.)

hCursor

Numeric, input

Specifies the handle to a cursor that is used for looking at messages in the queue. The MSMQCREATECURSOR routine is used to create a cursor and obtain its handle.

transObj

Numeric, input

Specifies the transaction object that is obtained from a previous MSMQBEGINTRANS function call. If this value is set to zero, then it is assumed that this operation will not be part of a transaction.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

propids

Character, input

Identifies one or more message properties that affects the message being received from the queue. This parameter is a character string with each applicable property separated by a comma. You must provide a *value* parameter for each property specified in the *propids* string. Each property ID in the *propids* string is associated positionally with a *value* parameter. The CALL routine returns the corresponding property value into each *value* parameter.

The following receive message properties and *values* are valid:

ACKNOWLEDGE

Retrieves the type of acknowledgment messages that MSMQ posts when the message was sent. Initialize the variable appropriately to prevent truncation of the retrieved value from occurring. Possible acknowledge types are as follows:

NONE

Specifies no acknowledgment messages are posted.

FULL_REACH_QUEUE

Specifies that positive and negative acknowledgments are posted, indicating whether the message reaches the queue.

FULL_RECEIVE

Specifies that positive and negative acknowledgments are posted, depending on whether the message is retrieved from the queue before its time-to-be-received timer expires.

NACK_REACH_QUEUE

Specifies that negative acknowledgments are posted when a message cannot reach the queue.

NACK_RECEIVE

Specifies that negative acknowledgments are posted when a message cannot be retrieved from the queue.

ADMIN_QUEUE

Retrieves the queue used for MSMQ-generated acknowledgment messages. This value is a character string that represents the pathname of the administration queue. You can use the MSMQPATHTOFORMAT CALL routine to obtain a queue identifier for this queue. Initialize the variable appropriately to prevent truncation of the returned value from occurring.

APPSPECIFIC

Retrieves the application-generated information. The value is numeric, and the default is 0.

ARRIVEDTIME

Retrieves the time the message arrived at the queue. The value is a numeric that represents the number of seconds elapsed since midnight (00:00:00), January 1, 1970 (Coordinated Universal time).

AUTHENTICATED

Retrieves whether the message was authenticated. The following values are valid:

- 0 : Message is *not* authenticated.
- 1 : Message is authenticated.

BODY

Specifies whether the message body should be received. The following values are valid:

- 0 : Specifies *not* to retrieve the body of the message.
- 1 (default) : Specifies to retrieve the body of the message

BODY_SIZE

Retrieves the actual size of the message body. The body size is a numeric value.

BODY_TYPE

Retrieves the type of body the message contains. The value is numeric.

CLASS

Retrieves the class of the message. The value is a numeric.

CORRELATIONID

Retrieves the correlation identifier of the message. The value is a character string that represents binary data. Initialize the variable to a size of at least 40 to guarantee that truncation of the returned value does not occur.

DELIVERY

Retrieves how the message is delivered. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

EXPRESS

Specifies faster, non-guaranteed delivery.

RECOVERABLE

Specifies guaranteed delivery.

DEST_QUEUE

Retrieves the target queue of the message. This value is a character string that represents the pathname of the destination queue. You can use the **MSMQPATHTOFORMAT CALL** routine to obtain a queue identifier for this queue. Initialize the variable appropriately to prevent truncation of the returned value from occurring.

JOURNAL

Retrieves journal enablement. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

NONE (default)

Specifies the message is not kept in the originating machine's journal queue.

JOURNAL

Specifies the message is kept in the originating machine's journal queue.

DEADLETTER

Specifies the message is kept in a dead letter queue if it cannot be delivered.

Note: A combination can be specified by separating each value with a comma (for example, JOURNAL,DEADLETTER.) △

LABEL

Retrieves a label for the message. The label value is a character string. Initialize the variable appropriately to prevent truncation of the returned value from occurring.

MSGID

Retrieves MSMQ-generated identifier of the message. The value is a character string that represents binary data. Initialize the variable to a size of at least 40 to guarantee that truncation of the returned value does not occur.

Note: This value is returned as a binary string. MSMQ Explorer displays the message identifier as a UUID concatenated with a sequence number. △

PRIORITY

Retrieves the message's priority. The value is a numeric between 0 and 7. The highest priority is 7, and the default priority is 3.

PRIV_LEVEL

Retrieves the privacy level of the message. Initialize the variable appropriately to prevent truncation of the returned value from occurring. The following values are valid:

PUBLIC

Specifies the message is to be sent as clear-text.

PRIVATE

Specifies end-to-end encryption of the message body.

RESP_QUEUE

Retrieves the pathname of the queue where application-generated response messages are returned. The value is a character string that represents the pathname of the response queue. You can use the MSMQPATHTOFORMAT CALL routine to obtain a queue identifier for this queue. Initialize the variable appropriately to prevent truncation of the returned value from occurring.

SENDER_CERT

Retrieves the certificate that was used to authenticate the message. This value is a character string. If an external certificate was used to authenticate the message, the information that is returned can be used to verify who sent the message (subject).

SENDERID

Retrieves who sent the message. The value is a character string.

SENTTIME

Retrieves the time the message was sent. The value is a numeric that represents the number of seconds elapsed since midnight (00:00:00), January 1, 1970 (Coordinated Universal time).

SRC_MACHINE_ID

Retrieves the UUID of the computer where the message was sent. This value is a UUID in the form of a character string that represents the binary data. Initialize

the variable to a size of at least 32 to guarantee that truncation of the returned value does not occur.

TIME_TO_BE_RECEIVED

Retrieves the total time (in seconds) that the message is to be available. The value is a numeric with a default of infinity.

TIME_TO_REACH_QUEUE

Retrieves time limit (in seconds) for the message to reach the queue.

TRACE

Retrieves where report messages are sent when tracing a message. Initialize the variable appropriately to guarantee that truncation of the returned value does not occur. The following values are valid:

NONE

Specifies no tracing for this message.

REPORT

Specifies report messages are to be sent to the report queue that is specified by the source queue manager.

VERSION

Retrieves the version of MSMQ that is used to send the message. The value is a numeric.

Details

When reading messages, you can either peek at or retrieve them from the queue. The message is retrieved into an internal SAS buffer at which time you should call `MSMQGETPARMS` to set SAS variables (parameters) to that data.

Example

This example receives a message.

```
length msg $ 200;
length arrivet auth size respq sentt 8;
length correlid msgid $ 40;
length label $ 80;
rc=0;
hCursor=0;
transobj=0;
CALL MSMQRECEIVMSG(hQueue, 0, "RECEIVE", hCursor, transobj, rc,
                   "ARRIVEDTIME,AUTHENTICATED,BODY_SIZE,CORRELATIONID,
                   LABEL,MSGID,RESP_QUEUE,SENTTIME",
                   arrivet, auth, size, correlid, label, msgid, respq, sentt);
if rc ^= 0 then do;
  put 'MSMQReceiveMsg: failed';
  msg = sysmsg();
  put msg;
end;
else do;
  put 'MSMQReceiveMsg: succeeded';
  /* convert MSMQ arrived time to SAS datetime format */
  arrivet = arrivet + 10*365*24*3600 + 3*24*3600 - 5*3600;
  put 'arrived time is' arrivet datetime.;
  if auth = 1 then put 'message was authenticated';
```

```

else put 'message was not authenticated';
put 'message body size is ' size;
put 'correlation id is ' correlid;
put 'label is ' label;
put 'msg id is ' msgid;
put 'resp_queue qid handle is ' respq;
/* convert MSMQ sent time to SAS datetime format */
sentt = sentt + 10*365*24*3600 + 3*24*3600 - 5*3600;
put 'sent time was' sentt datetime.;
end;

```

MSMQRELEASETRANS

Releases an internal MSMQ transaction object, thereby allowing MSMQ to release the associated resources.

Syntax

```
CALL MSMQRELEASETRANS(transObj, rc);
```

Arguments

transObj

Numeric, input

Specifies the transaction object that is obtained from a previous MSMQBEGINTRANS function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

Example

This example releases a transaction unit of work.

```

length msg $ 200;
rc=0;
CALL MSMQRELEASETRANS(transobj, rc);
if rc ^= 0 then do;
  put 'MSMQReleaseTrans: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQReleaseTrans: succeeded';

```

MSMQSENDMSG

Sends a message to the specified queue.

Syntax

```
CALL MSMQSENDMSG(hQueue, hData, transObj, rc, propids, value1 <,value2, ...>);
```

Arguments

hQueue

Numeric, input

Specifies the MSMQ handle to an open queue. This parameter is obtained from a previous MSMQOPENQUEUE function call.

hData

Numeric, input

Specifies the SAS internal data descriptor handle that is obtained from a previous MSMQSETPARMS function call. If this value is set to zero, then it is assumed that no data will accompany this message.

transObj

Numeric, input

Specifies the transaction object obtained from a previous MSMQBEGINTRANS function call. If this value is set to zero, then it is assumed that this operation will not be part of a transaction.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

propids

Character, input

Identifies one or more message properties that affects the message being sent. This parameter is a character string with each applicable property separated by a comma. You must provide a *value* parameter for each property specified in the *propids* string. Each property ID in the *propids* string is associated positionally with a *value* parameter.

Note: All values are inputs to the MSMQSENDMSG routine except MSGID which returns a message identifier. △

The following send message properties and *values* are valid:

ACKNOWLEDGE

Specifies the type of acknowledgment messages that MSMQ posts when the message is sent. A positive acknowledgment indicates the message sent was received successfully. A negative acknowledgment indicates the message was not received.

Possible acknowledge types are as follows:

NONE (default)

Specifies no acknowledgment messages are posted.

FULL_REACH_QUEUE

Specifies that positive and negative acknowledgments are posted, indicating whether the message reaches the queue.

FULL_RECEIVE

Specifies that positive and negative acknowledgments are posted, indicating whether the message is retrieved from the queue.

NACK_REACH_QUEUE

Specifies that negative acknowledgments are posted when a message cannot reach the queue.

NACK_RECEIVE

Specifies that negative acknowledgments are posted when a message cannot be retrieved from the queue.

ADMIN_QUEUE

Specifies the pathname of the queue that is used for MSMQ-generated acknowledgment messages. The value is a character string that represents the pathname of the administration queue.

APPSPECIFIC

Specifies application-generated information. The value is numeric and the default is 0.

AUTH_LEVEL

Specifies whether the message needs to be authenticated.
The following AUTH_LEVEL types are valid:

NONE (default)

Specifies that no authentication is necessary. (Messages are not signed.)

ALWAYS

Specifies that messages are always signed and authenticated by the destination queue manager.

BODY_TYPE

Specifies the type of body the message contains. The value is numeric and is defined by the application and must be coordinated between the sending and receiving portions of the application. The default value is 0.

CORRELATIONID

Specifies the correlation identifier of the message. The value is a character string that represents binary data.

DELIVERY

Specifies how the message is delivered. The following values are valid:

EXPRESS (default)

Specifies faster, non-guaranteed delivery.

RECOVERABLE

Specifies guaranteed delivery.

ENCRYPTION_ALG

Specifies the encryption algorithm that is used to encrypt the message body of a private message. Possible values are as follows:

- RC2 (Block cipher) (Default)
- RC4 (Stream cipher)

HASH_ALG

Specifies the hashing algorithm that is used when authenticating messages. The following values are valid:

MD2

Message Digest 2 Algorithm

MD4

Message Digest 4 Algorithm

MD5 (default)

Message Digest 5 Algorithm

JOURNAL

Specifies whether the message should be kept in a machine journal, sent to a dead letter queue, or neither. The following values are valid:

NONE (default)

Specifies the message is not kept in the originating machine's journal queue.

JOURNAL

Specifies the message is kept in the originating machine's journal queue.

DEADLETTER

Specifies the message is kept in a dead letter queue if it cannot be delivered.

Note: A combination can be specified by separating each value with a comma (for example, JOURNAL,DEADLETTER.) △

LABEL

Specifies a label for the message. The default is a blank label ().

MSGID

Specifies MSMQ-generated identifier of the message. The value is a character string that represents binary data. Initialize the variable to a size of at least 40 to guarantee that truncation of the returned value does not occur.

Note: This value is returned as a binary string. MSMQ Explorer displays the message identifier as a UUID concatenated with a sequence number. △

PRIORITY

Specifies the message's priority. The value is a numeric between 0 and 7. The highest priority is 7, and the default priority is 3.

PRIV_LEVEL

Specifies the privacy level of the message. The following values are valid:

PUBLIC (default)

Specifies the message is to be sent as clear-text.

PRIVATE

Specifies end-to-end encryption of the message body.

RESP_QUEUE

Specifies the pathname of the queue where application-generated response messages are returned. The value is a character string that represents the pathname of the response queue.

SECURITY_CONTEXT

Specifies security information that MSMQ uses to authenticate messages. The value is the handle to the security context buffer that is returned from MSMQGETCONTEXT.

SENDER_CERT

Specifies the name of the system certificate store to use in order to locate external certificates during the authentication process. Generally, MY is used. For example, if a value of MY is used, the registry location used to retrieve the system certificate is as follows:

```
HKEY_CURRENTUSER\Software\Microsoft\SystemCertificates\MY\Certificates
```

TIME_TO_BE_RECEIVED

Specifies the total time (in seconds) that the message is to be available. The default value is infinite.

TIME_TO_REACH_QUEUE

Specifies time limit (in seconds) for the message to reach the queue.

TRACE

Specifies where report messages are sent when tracing a message. The following values are valid:

NONE (default)

Specifies no tracing for this message.

REPORT

Specifies report messages are to be sent to the report queue that is specified by the source queue manager.

Note: The BODY message property is set internally, based on whether data is present. △

Example

This example sends a message.

```
length msg $ 200;
rc=0;
transobj=0;
CALL MSMQSENDMSG(hQueue,
hData,
transobj,
rc,
''AUTH_LEVEL,APPSPECIFIC,CORRELATIONID,LABEL,PRIV_LEVEL,RESP_QUEUE'',
''ALWAYS'', 999, ''0102030405060708090A0B0C0D0E0F1011121314'',
''Secret test message'', ''PRIVATE'', ''mypc\respq'');
if rc ^= 0 then do;
    put 'MSMQSendMsg: failed';
    msg = sysmsg();
    put msg;
end;
else put 'MSMQSendMsg: succeeded';
```

MSMQSETPARMS

Creates a data descriptor that describes the actual SAS variables along with an associated data mapping. This data descriptor can then be used on a subsequent MSMQSENDMSG call.

Syntax

```
CALL MSMQSETPARMS(hData, hMap, rc, parm1 <,parm2, parm3, ...>);
```

Arguments

hData

Numeric, output

Returns the SAS internal data descriptor handle that is generated.

hMap

Numeric, input

Specifies the SAS internal map descriptor handle that is obtained from a previous MSMQMAP function call. If set to zero, then no external defined mapping is assumed and therefore, all data is mapped according to SAS internal representations. That is, all numerics are mapped as doubles and all strings are mapped as character data of the current string length.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

parms

Numeric or character, input

Specifies one or more parameters that are used to define the values of SAS variables in a message.

Example

This example sets values of SAS variables into a message.

```
hData=0;
rc=0;
parm1=100;
parm2=9999;
parm3=9999.9999;
parm4='This is a test.';
CALL MSMQSETPARMS(hData, hMap, rc, parm1, parm2, parm3, parm4);
```

MSMQSETQPROP

Sets the properties of a specific queue.

Syntax

```
CALL MSMQSETQPROP(qid, rc, propids, value1 <,value2, ...>);
```

Arguments

qid

Numeric, input

Specifies the queue identifier that represents the format name of the queue.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

propids

Character, input

Identifies one or more properties that you want to set. This parameter is a character string with each applicable property separated by a comma. For each property identified by *propids*, you must provide a *value* parameter that specifies the value to use to set the property. The following *propids* and *values* are valid:

AUTHENTICATE

Specifies whether the queue accepts only authenticated messages. The following values are valid:

NONE

Specifies the queue accepts either authenticated or non-authenticated messages.

ALWAYS

Specifies the queue always requires authenticated messages.

BASEPRIORITY

Specifies the base priority for all messages that are sent to a public queue. The value is a numeric that ranges from -32768 to 32767, where 32767 is the highest priority and 0 is the default priority.

JOURNAL

Specifies if messages are also copied to its journal queue. The following values are valid:

NONE

Specifies that messages removed from the queue are discarded.

ALWAYS

Specifies that messages removed from the queue are always stored in its journal queue.

JOURNAL_QUOTA

Specifies the maximum size (in kilobytes) of the journal queue.

LABEL

Specifies a description of the queue. The value is a character string.

PRIV_LEVEL

Specifies the privacy level that is required by the queue. The value is a character string. The following values are valid:

NONE

Specifies that the queue accepts only non-private (clear-text) messages.

BODY

Specifies that the queue accepts only private (encrypted) messages.

OPTIONAL

Specifies that the queue accepts both private and non-private messages.

QUOTA

Specifies the maximum size (in kilobytes) of the queue.

TYPE

Specifies the type of service that is provided by the queue. The value of the TYPE property is a universal unique identifier (UUID) in the form of a character string that represents the binary data.

Example

This example sets the queue properties.

```
length msg $ 200;
rc=0;
CALL MSMQSETQPROP(qid, rc, "AUTHENTICATE,BASEPRIORITY,JOURNAL,JOURNAL_QUOTA,
                           LABEL,PRIV_LEVEL,QUOTA,TYPE",
                           "ALWAYS", 1, "ALWAYS", 32767, "New Label",
                           "BODY", 32767, "0A0B0C0D0E0F0102030405060708090A");

if rc ^= 0 then do;
  put 'MSMQSetQProp: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQSetQProp: succeeded';
```

MSMQSETQSEC

Sets the access control information for a specified queue.

Syntax

```
CALL MSMQSETQSEC(qid, rc <,owner, dacl>);
```

Arguments***qid***

Numeric, input

Specifies the queue identifier that represents the format name of the queue.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. A return code of -1 reflects a SAS internal error. Otherwise, it represents an MSMQ error code. You can use the SAS function SYSMSG() to obtain a textual description of the return code.

owner

Character, input (Optional)

Identifies the owner of the queue. This parameter must be specified as Domain\Account.

dacl

Character, input (Optional)

Specifies the discretionary access control list for the queue. This parameter must be specified in the form of

```
Domain\Account:accessType:Permissions,...
```

where *accessType* is one of the following:

ALLOW

Permissions allowed

DENY (See the following note.)

Permissions denied

Note: Windows NT 4.0 supports DENY access control entries but cannot edit security information that uses them. Therefore, this access type is not recommended until Windows NT 5.0 or later. *Permissions* is one or more of the following separated by '+':

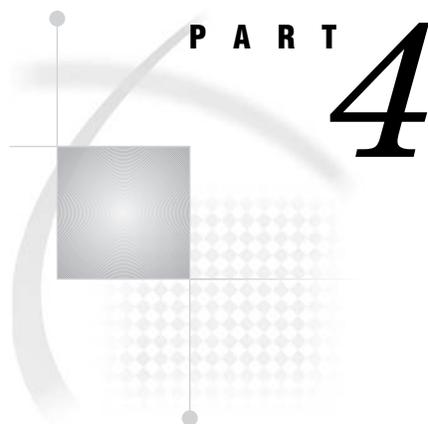
- Rj (Receive Journal)
- Rq (Receive Message)
- Pq (Peek Message)
- Sq (Send Message)
- Sp (Set Properties)
- Gp (Get Properties)
- D (Delete Queue)
- Pg (Get Permissions)
- Ps (Set Permissions)
- O (Take Ownership)

△

Example

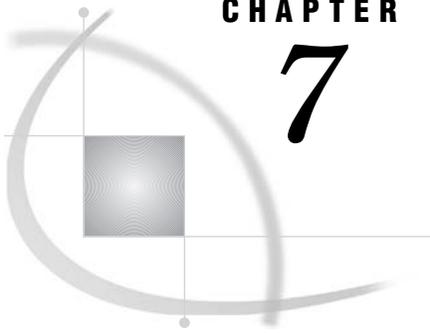
This example sets the queue security properties to allow NTDOMAIN\User6 to Receive Messages (Rq), Get Properties (Gp), and Get Permissions (Pg).

```
length msg $ 200;
rc=0;
CALL MSMQSETQSEC(qid, rc, '', 'NTDOMAIN\User6:ALLOW:Rq+Gp+Pg');
if rc ^= 0 then do;
  put 'MSMQSetQSec: failed';
  msg = sysmsg();
  put msg;
end;
else put 'MSMQSetQSec: succeeded';
```

SAS Common Messaging Interface

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CHAPTER

7

Using the SAS Common Messaging Interface

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Common Messaging Interface

The SAS Common Messaging Interface provides the following:

- a seamless environment for writing applications that access message queues of the IBM WebSphere MQ (previously named MQSeries), Microsoft MSMQ, and TIBCO TIB/Rendezvous transports
- a way to use the local SAS registry to store and retrieve messaging information

The common interface to WebSphere MQ, MSMQ, and Rendezvous enables your application programs to interact in a consistent manner that is independent of your transport.

This section describes the use of the interface and provides reference information for each SAS CALL routine. For the CALL routine reference, see Chapter 8, “Common Messaging Interface Call Routines,” on page 205.

Writing Applications Using the Common Messaging Interface

Introduction to Writing Applications with the Common Messaging Interface

Two general types of programs can use the common messaging interface. One uses the interface to administer information about the message transports. Another uses the interface to send and receive messages between applications. These two types of programs are discussed in the sections below.

Note: The SAS[®]9 Common Messaging Interface uses the SAS[®]9 data set format by default. In order to send and receive SAS Release 8 data sets, you must include the "ATTACH_VERSION=VERSION_8" option in the data set option list on the SENDMESSAGE call. If you do not use the "ATTACH_VERSION=VERSION_8" option on the SENDMESSAGE call, then received data sets are stored in the SAS[®]9 format. If you might be sending data sets to another SAS session that is running SAS Release 8.2 or earlier, then use the ATTACH_VERSION= option to exchange data sets in a format that can be interpreted by both applications. \triangle

Administrator Programs

SAS programs can use the common messaging interface in order to administer the information in the repository for the queues. The goal of such an *administrator program* is to encapsulate all information about the queues so that all other programs in the application can focus on using the queues rather than configuring them. This not only simplifies the other programs, but also makes the queues easier to administer by having all of this information in one location.

Administrator programs perform general functions, such as the following:

- defining the transport-specific details that are required by the queue. The available transports are MQSeries (WebSphere MQ), MSMQ, Rendezvous, or Rendezvous-CM.
- setting aliases for new transports and queues and retrieving aliases for existing ones.
- retrieving the properties of a queue.
- defining and retrieving maps to data descriptors that identify the data type, offset, and length.
- setting and retrieving dynamic creation queue models for the MSMQ transport.
- setting and retrieving transport definition models for Rendezvous (optional) and Rendezvous-CM (required).

The following SAS CALL routines are used to administer the information repository:

- “SETALIAS” on page 244
- “SETMAP” on page 246
- “SETMODEL” on page 247
- “GETALIAS” on page 215
- “GETMAP” on page 218
- “GETMODEL” on page 220
- “GETQUEUEPROPS” on page 221

Other functions of the administration process include removing any unneeded information in the repository. This encompasses functions such as the following:

- deleting a transport or queue alias definition
- deleting a data descriptor definition map
- deleting a dynamic or transport model definition

The following SAS CALL routines are used to administer these aspects of the information repository:

- “DELETEALIAS” on page 211
- “DELETEMAP” on page 212
- “DELETEMODEL” on page 213

User Programs

This section describes how a SAS program can use the common messaging interface in order to access message queues to send and receive messages to other programs. The

common interface alleviates the need for these *user programs* to use transport-specific code. This makes the user programs less vulnerable to changes in the queue's attributes. The programs interact with each queue in a consistent matter, independent of the transport.

User programs perform general functions such as the following:

- initializing the type of transport and obtaining a unique identifier
- opening an existing queue by using a known transport identifier
- sending messages to a queue by using a unique queue identifier
- receiving messages (and possibly attachments) from a queue
- parsing the message
- getting attachments that are associated with a message (if necessary)
- copying any desired attachments to local storage
- closing all queues upon completion of the program tasks
- terminating transports that are initialized by the program

The following SAS CALL routines are the basis for initializing or terminating a transport, opening or closing a queue, and sending or receiving messages and attachments:

- "INIT" on page 224
- "TERM" on page 251
- "OPENQUEUE" on page 225
- "CLOSEQUEUE" on page 209
- "SENDMESSAGE" on page 236
- "RECEIVEMESSAGE" on page 230
- "PARSEMMESSAGE" on page 229
- "GETATTACHMENT" on page 216
- "ACCEPTATTACHMENT" on page 206

In addition, user programs can perform transaction processing on transaction queues. Such functions include the following:

- creating a transaction object in order to begin progressing
- committing or canceling work that is performed by using a transaction object
- releasing a transaction object and any resource that is associated with it

The following SAS CALL routines are provided for applications that require transaction processing:

- "BEGINTRANSACTION" on page 208
- "COMMIT" on page 210
- "ABORT" on page 205
- "FREETRANSACTION" on page 214

Using TIB/Rendezvous with the SAS Common Messaging Interface

Overview of Using TIB/Rendezvous with the SAS Common Messaging Interface

SAS Integration Technologies supports the message delivery features of TIB/Rendezvous Release 7.5.4 and later.

TIB/Rendezvous is a leading messaging middleware product from TIBCO Software, Inc. Like IBM WebSphere MQ (previously named MQSeries) and Microsoft MSMQ, TIB/Rendezvous makes it easy to create distributed applications across heterogeneous systems.

The SAS Common Messaging Interface includes messaging functions that are common to WebSphere MQ, MSMQ, and Rendezvous. However, the TIB/Rendezvous message delivery system differs from the other transports in some important ways. Developers must take these differences into account when using the Common Messaging Interface to support Rendezvous-based applications. The main differences are as follows:

- Rendezvous uses an approach called *subject-based addressing*. While both WebSphere MQ and MSMQ deliver messages to specific destination queues using queue names, Rendezvous broadcasts messages that have been labeled with user-defined *subject names*. Data consumer applications *listen* for particular subject names and receive messages only when the subject name matches a name being listened for. The communicating programs must agree in advance on the subject names to be used and the forms of messages to be exchanged.
- Because messages are broadcast to subject names instead of specific destination queues, a message can be received only by stations that are online and actively listening for the subject name associated with the message.

Chapter 8, “Common Messaging Interface Call Routines,” on page 205 explains how to use the SAS Common Messaging Interface to access the unique features of TIB/Rendezvous. “TIB/Rendezvous Coding Example” on page 174 shows how to use the SAS Common Messaging Interface with TIB/Rendezvous. For additional information, please consult the TIBCO documentation.

Rendezvous Certified Message Delivery (Rendezvous-CM)

Certified message delivery features offers a stronger assurance of delivery than reliable message delivery. Certified message delivery protocols also offer the following:

- tighter control
- greater flexibility
- fine-grained reporting

To determine whether you should use Rendezvous certified message delivery, please consult the TIBCO documentation.

Chapter 8, “Common Messaging Interface Call Routines,” on page 205 explains how to use the SAS Common Messaging Interface to access the features of TIB/Rendezvous Certified Message Delivery. “TIB/Rendezvous Certified Messaging Coding Examples” on

page 176 shows how to use the SAS Common Messaging Interface with TIB/Rendezvous Certified Message Delivery. For additional information, please consult the TIBCO documentation.

TIB/Rendezvous Coding Example

The following example of a SAS DATA step shows how to use the SAS Common Messaging Interface with the TIB/Rendezvous transport to send and receive messages using subject-based addressing.

```

data _null_;

    length msg $ 200;
    length qid qid2 tid rc attchflg 8;
    length parm1 parm2 parm3 recv1 recv2 recv3 8;
    length parm4 recv4 $50;
    length map $ 80;
    length event $ 10;

    tid=0;
    rc=0;
    put '----';
    put 'Call INIT';
    CALL INIT(tid, 'RENDEZVOUS', rc);
    if rc ^= 0 then do;
        put 'INIT: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'INIT: succeeded';

    rc=0;
    qid=0;
    put '----';
    put 'Call OPENQUEUE for queue1 to listen
        for and receive messages';
    CALL OPENQUEUE(qid, tid, 'test.subject',
        'FETCH', rc, "POLL(Timeout=15)");
    if rc ^= 0 then do;
        put 'OPENQUEUE: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'OPENQUEUE: succeeded';

    rc=0;
    qid2=0;
    put '----';
    put 'Call OPENQUEUE for queue2 to send messages';
    CALL OPENQUEUE(qid2, tid, 'test.subject',
        'DELIVERY', rc);
    if rc ^= 0 then do;
        put 'OPENQUEUE: failed';
    end;

```

```

    msg = sysmsg();
    put msg;
end;
else put 'OPENQUEUE: succeeded';

rc=0;
put '----';
put 'Call SETMAP';
CALL SETMAP('mymap', 'REGISTRY', rc,
            'SHORT;LONG;DOUBLE;CHAR,,50');
if rc ^= 0 then do;
    put 'SETMAP: failed';
    msg = sysmsg();
    put msg;
end;
else put 'SETMAP: succeeded';

parm1=100;
parm2=9999;
parm3=9999.1234;
parm4="ABCDEFGHJKLMNOPQRSTUVWXYZ";

put '----';
put 'Call SENDMESSAGE';
call sendmessage(qid2,rc,"map","mymap" ,
                parm1,parm2,parm3,parm4);
if rc ^= 0 then do;
    put 'send message failed: ';
    msg=sysmsg();
    put msg;
end;
else put 'send message succeeded';

rc = 0;
put '----';
put 'Call RECEIVEMESSAGE';

map = "mymap";
call receivemessage(qid, rc, event,
                   attchflg,"map",map,recv1,recv2,recv3,recv4);
put 'qid = ' qid;
put 'event = ' event;
put 'attchflg = ' attchflg;
if rc ^= 0 then do;
    put 'receive message failed: ';
    msg=sysmsg();
    put msg;
end;
else do;
    put 'receive message succeeded';
    put map;
end;
if event eq 'DELIVERY' then
do;

```

```

        put 'Message has been delivered';
        put 'recv1 = ' recv1;
        put 'recv2 = ' recv2;
        put 'recv3 = ' recv3;
        put 'recv4 = ' recv4;
    end;

    rc=0;
    put '----';
    put 'Call CLOSEQUEUE for queue2';
    CALL CLOSEQUEUE(qid2, rc);
    if rc ^= 0 then do;
        put 'CLOSEQUEUE: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'CLOSEQUEUE: succeeded';

    rc=0;
    put '----';
    put 'Call CLOSEQUEUE for queue1';
    CALL CLOSEQUEUE(qid, rc);
    if rc ^= 0 then do;
        put 'CLOSEQUEUE: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'CLOSEQUEUE: succeeded';

    rc=0;
    put '----';
    put 'Call TERM';
    CALL TERM(tid, rc);
    if rc ^= 0 then do;
        put 'TERM: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'TERM: succeeded';

run;

```

TIB/Rendezvous Certified Messaging Coding Examples

Example 1: Sending and Receiving Messages in the Same DATA Step

In this example, the sender and listener use the same DATA step.

```

data _null_;

    length msg $ 200;
    length qid qid2 tid rc 8;
    length map $80;
    length recv1 recv2 recv3 8;
    length recv4 $50;
    length event $10;

    tid=0;
    rc=0;
    put '----';
    put 'Call INIT';
    CALL INIT(tid, 'RENDEZVOUS-CM', rc);
    if rc ^= 0 then do;
        put 'INIT: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'INIT: succeeded';

    call setmodel("RENDEZVOUS-CM", "RENDCMSENDER",
        "REGISTRY", rc, "CMNAME, LEDGER",
        "cmsender", "c:\cmsendledger.txt");
    if rc ^= 0 then do;
        put 'SETMODEL: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'SETMODEL: succeeded';

    call setmodel("RENDEZVOUS-CM", "RENDCMRECEIVE",
        "REGISTRY", rc, "CMNAME, LEDGER, REQUESTOLD,
        SYNCLEDGER", "cmreceive", "c:\cmrcvledger.txt",
        "YES", "NO");
    if rc ^= 0 then do;
        put 'SETMODEL: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'SETMODEL: succeeded';

    rc=0;
    put '----';
    put 'Call SETMAP';
    CALL SETMAP('rendmap', 'REGISTRY', rc,
        'SHORT;LONG;DOUBLE;CHAR,,50');
    if rc ^= 0 then do;
        put 'SETMAP: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'SETMAP: succeeded';

```

```

rc=0;
qid2=0;
put '----';
put 'Call OPENQUEUE';
CALL OPENQUEUE(qid2, tid, 'testcm.subject',
'DELIVERY', rc, "DYNAMIC(Model=rendcmsender)");
if rc ^= 0 then do;
  put 'OPENQUEUE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'OPENQUEUE: succeeded';
put "qid2= " qid2;

rc=0;
qid=0;
put '----';
put 'Call OPENQUEUE';
CALL OPENQUEUE(qid, tid, 'testcm.subject', 'FETCH', rc,
"DYNAMIC(Model=rendcmreceive)", "POLL(Timeout=15)");
if rc ^= 0 then do;
  put 'OPENQUEUE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'OPENQUEUE: succeeded';
put "qid= " qid;

/* send a message */
parm1=100;
parm2=9999;
parm3=9999.1234;
parm4="Demonstrating the rendezvous message api.";

put '----';
put 'Call SENDMESSAGE';
call sendmessage(qid2,rc,"map","rendmap" ,
  parm1,parm2,parm3,parm4);
if rc ^= 0 then do;
  put 'send message failed: ';
  msg=sysmsg();
  put msg;
end;
else put 'send message succeeded';

rc = 0;
put '----';
put 'Call RECEIVEMESSAGE';

map = "rendmap";
call receivemessage(qid, rc, event,
  attchflg,"map",map,rcv1,rcv2,rcv3,rcv4);
put 'qid = ' qid;
put 'event = ' event;

```

```

put 'attchflg =' attchflg;
if rc ^= 0 then do;
  put 'receive message failed: ';
  msg=sysmsg();
  put msg;
end;
else do;
  put 'receive message succeeded';
  put map;
end;
if event eq 'DELIVERY' then
do;
  put 'Message has been delivered';
  if attchflg eq 1 then do;
    put 'Attachments are associated
      with this message';
    /* process attachments...*/
  end;
  put 'recv1 = ' recv1;
  put 'recv2 = ' recv2;
  put 'recv3 = ' recv3;
  put 'recv4 = ' recv4;
end;

rc=0;
put '----';
put 'Call CLOSEQUEUE for sender';
put "qid2= " qid2;
CALL CLOSEQUEUE(qid2, rc, "DELETE_PURGE");
if rc ^= 0 then do;
  put 'CLOSEQUEUE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'CLOSEQUEUE: succeeded';

rc=0;
put '----';
put 'Call CLOSEQUEUE for receiver';
put "qid= " qid;
CALL CLOSEQUEUE(qid, rc, "DELETE_PURGE");
if rc ^= 0 then do;
  put 'CLOSEQUEUE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'CLOSEQUEUE: succeeded';

rc=0;
put '----';
put 'Call TERM';
CALL TERM(tid, rc);
if rc ^= 0 then do;

```

```

        put 'TERM: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'TERM: succeeded';

run;

```

Example 2: Sending and Receiving Messages in Separate DATA Steps

Overview

In this example, the sender and listener use separate DATA steps. Each DATA step is run in a separate SAS session. The receiving DATA step needs to start running before the sending DATA step ends.

Sending DATA Step

```

/* SAS DATA step to send a certified message */

data _null_;

    length msg $ 200;
    length qid2 tid rc 8;
    length map $80;
    length recv4 $50;
    length event $10;
    length queue $ 80;

    tid=0;
    rc=0;
    call setmodel("RENDEZVOUS-CM", "RENDCMSENDER",
        "REGISTRY", rc, "CMNAME, LEDGER", "cmsender",
        "c:\sendledger.txt");
    if rc ^= 0 then do;
        put 'SETMODEL: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'SETMODEL: succeeded';

    rc=0;
    put '----';
    put 'Call SETMAP';
    CALL SETMAP('rendmap', 'REGISTRY', rc,
        'SHORT;LONG;DOUBLE;CHAR,,50');
    if rc ^= 0 then do;
        put 'SETMAP: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'SETMAP: succeeded';

```

```

call setalias("queue", "tibcmalias", "REGISTRY",
             rc, "RENDEZVOUS-CM", "send.cmmmsg");
if rc ^= 0 then do;
    put 'set_alias failed: ';
    msg=sysmsg();
    put msg;
end;
else put 'set_alias succeeded';
put ' this should be next';

rc=0;
qname = "tibcmalias";
qid2=0;
put '----';
put 'Call OPENQUEUE for queue2';
CALL OPENQUEUE(qid2, tid, qname, 'DELIVERY',
              rc, "DYNAMIC(Model=rendcmsender)");
if rc ^= 0 then do;
    put 'OPENQUEUE: failed';
    msg = sysmsg();
    put msg;
end;
else put 'OPENQUEUE: succeeded';

/* send a message */
parm1=100;
parm2=9999;
parm3=9999.1234;
parm4="Demonstrating the rendezvous message api.";

put '----';
put 'Call SENDMESSAGE';
call sendmessage(qid2,rc,"map, addlistener","rendmap",
                "cmreceive",parm1,parm2,parm3,parm4);
if rc ^= 0 then do;
    put 'send message failed: ';
    msg=sysmsg();
    put msg;
end;
else put 'send message succeeded';

/*
 * This or another instance of the certified transport
 * named cmsender must be active to deliver certified
 * messages to the listener.
 */
slept = sleep(15);

rc=0;
put '----';
put 'Call CLOSEQUEUE for queue2';
CALL CLOSEQUEUE(qid2, rc);

```

```

    if rc ^= 0 then do;
        put 'CLOSEQUEUE: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'CLOSEQUEUE: succeeded';

```

```
run;
```

Receiving DATA Step

```

/* SAS DATA step to receive certified messages */

data _null_;

    length msg $ 200;
    length qid tid rc 8;
    length map $80;
    length event $10;
    length queue $ 80;
    length token $300;
    length attach $10;
    length recv1 recv2 recv3 8;
    length recv4 $50;
    length certified $8;
    length sendername $50;

    rc=0;
    call setmodel("RENDEZVOUS-CM", "RENDCMRECEIVE",
        "REGISTRY", rc, "CMNAME, LEDGER, REQUESTOLD",
        "cmreceive", "c:\recvledger.txt", "YES");

    if rc ^= 0 then do;
        put 'SETMODEL: failed';
        msg = sysmsg();
        put msg;
    end;
    else put 'SETMODEL: succeeded';

    call setalias("queue", "tibcmalias", "REGISTRY",
        rc, "RENDEZVOUS-CM", "send.cmmsg");
    if rc ^= 0 then do;
        put 'set_alias failed: ';
        msg=sysmsg();
        put msg;
    end;
    else put 'set_alias succeeded';

    rc=0;
    qid=0;
    tid = 0;
    qname = "tibcmalias";
    put '----';
    put 'Call OPENQUEUE';

```

```

CALL OPENQUEUE(qid, tid, qname, 'FETCH', rc,
  "DYNAMIC(Model=rendcmreceive)", "POLL(TIMEOUT=30)");
if rc ^= 0 then do;
  put 'OPENQUEUE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'OPENQUEUE: succeeded';
put "qid= " qid;

put "CALL receivemessage";
map = "rendmap";
call receivemessage(qid, rc, event,
  attchflg,"map,certified,sendername",map, certified,
  sendername, recv1,recv2,recv3,recv4);
put 'qid = ' qid;
put 'event = ' event;
put 'attchflg = ' attchflg;
put 'certified = ' certified;
put 'sendername = ' sendername;
if rc ^= 0 then do;
  put 'receive message failed: ';
  msg=sysmsg();
  put msg;
end;
else do;
  put 'receive message succeeded';
  put map;
end;
if event eq 'DELIVERY' then
do;
  put 'Message has been delivered';
  if attchflg eq 1 then do;
    put 'Attachments are associated
      with this message';
    /* process attachments...*/
  end;
  put 'recv1 = ' recv1;
  put 'recv2 = ' recv2;
  put 'recv3 = ' recv3;
  put 'recv4 = ' recv4;
end;

rc=0;
put '----';
put 'Call CLOSEQUEUE for queue1';
CALL CLOSEQUEUE(qid, rc);
if rc ^= 0 then do;
  put 'CLOSEQUEUE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'CLOSEQUEUE: succeeded';

```

```

rc=0;
put '----';

run;

```

Using a Repository with Application Messaging

The common messaging interface enables you to store information about message queues in the local SAS registry. The information that can be stored and retrieved include the following:

Transport alias	is an alias name that describes a transport (MQSeries [refers to WebSphere MQ], MSMQ, Rendezvous, or Rendezvous-CM)
Queue alias	is an alias name that describes a transport and queue
Dynamic queue model	is a model name that describes a queue's properties
Transport model	is a model name that describes a Rendezvous or Rendezvous-CM transport
Data map description	is a map name that describes the format of data within a message description

Placing this type of information in storage provides both reusability and encapsulation. A repository can contain all queue definitions, thereby enabling you to focus on the application usage rather than the specific definition of a queue.

The SAS registry provides methods for defining your own queues or overriding globally defined queues. It provides you with complete control and flexibility over a queue.

To bypass the SAS Registry altogether, specify the following macro variable:

```
%let REGISTRY_BYPASS=1.
```

For more information about using a repository with application messaging, see “Using the SAS Registry with the Common Messaging Interface” on page 184.

Using the SAS Registry with the Common Messaging Interface

Overview of Using the SAS Registry

The SAS registry can be used to store information about objects used for application messaging. This document provides information about using the SAS registry editor to view registry entries. It also provides a sample program for managing registry objects under program control.

Using the SAS Registry Editor

The SAS Registry Editor can be used to verify that values set programmatically for application messaging objects were set properly. To invoke the Registry Editor, select **Solutions ► Accessories ► Registry Editor** in the Base SAS menu.

The SAS registry has the following hierarchy for application messaging objects:

```
Products
  Base
    SAS Messaging
      Maps
      Models
      Queues
      Transports
```

Writing Applications to Access the SAS Registry

A typical program would configure information such as the following:

- Map data descriptor
- Queue and transport aliases
- Dynamic model for transport processing.

The following code illustrates how to set and retrieve information within the SAS Registry.

```
data _null_;

  length rc 8 msg $ 200;
  length descriptor transport queue label $ 80;
  length type $ 32;
  length auth journal priv trans $ 10;
  length basep journalq quota 8;

  put 'Registry Map creation...';
  call setmap('mymap', 'registry', rc,
    'char,0,80;double;');
  if rc ne 0 then do;
    put 'Setmap failed';
    msg = sysmsg();
    put msg;
  end;
  else put 'Setmap was successful';

  put 'Registry Map retrieval...';
  call getmap('mymap', 'registry', rc, descriptor);
  if rc ne 0 then do;
    put 'Getmap failed';
    msg = sysmsg();
    put msg;
  end;
  else do;
    put 'Getmap was successful';
    put 'descriptor = ' descriptor;
```

```

end;

put 'Registry Map deletion...';
call deletemap('mymap', 'registry', rc);
if rc ne 0 then do;
    put 'Deletemap failed';
    msg = sysmsg();
    put msg;
end;
else put 'Deletemap was successful';

put '-----';

put 'Registry Queue creation...';
call setalias('queue', 'myqueue', 'registry',
    rc, 'msmq', 'machine_name\queue_name');
if rc ne 0 then do;
    put 'Setalias failed';
    msg = sysmsg();
    put msg;
end;
else put 'Setalias succeeded';

put 'Registry Queue retrieval...';
call getalias('queue', 'myqueue', 'registry',
    rc, transport, queue);
if rc ne 0 then do;
    put 'Getalias failed';
    msg = sysmsg();
    put msg;
end;
else do;
    put 'Getalias succeeded';
    put 'transport = ' transport;
    put 'queue = ' queue;
end;

put '-----';

put 'Registry Transport creation...';
call setalias('transport', 'mytransport',
    'registry', rc, 'MSMQ');
if rc ne 0 then do;
    put 'Setalias failed';
    msg = sysmsg();
    put msg;
end;
else put 'Setalias succeeded';

put 'Registry Transport retrieval...';
call getalias('transport', 'mytransport',
    'registry', rc, transport);
if rc ne 0 then do;
    put 'Getalias failed';

```

```

    msg = sysmsg();
    put msg;
end;
else do;
    put 'Getalias succeeded';
    put 'transport = ' transport;
    put 'queue = ' queue;
end;

put '-----';

put 'Registry Model creation...';
call setmodel('msmq', 'mymodel', 'registry', rc,
    'authenticate, label',
    'always', 'Test Queue of MyModel');
if rc ne 0 then do;
    put 'Setmodel failed';
    msg = sysmsg();
    put msg;
end;
else put 'Setmodel succeeded';

put 'Registry Model retrieval...';
call getmodel('msmq', 'mymodel', 'registry', rc,
    'authenticate,basepriority,journal,
    journalquota,label,privlevel,quota,
    transaction,type',
    auth, basep, journal, journalq,
    label, priv, quota, trans, type);
if rc ne 0 then do;
    put 'Getmodel failed';
    msg = sysmsg();
    put msg;
end;
else do;
    put 'Getmodel succeeded';
    put 'authenticate = ' auth;
    put 'base priority = ' basep;
    put 'journal = ' journal;
    put 'journal quota = ' journalq;
    put 'label = ' label;
    put 'privacy level = ' priv;
    put 'quota = ' quota;
    put 'transaction = ' trans;
    put 'type = ' type;
end;

run;
quit;

```

Attachment Layout for WebSphere MQ and MSMQ

Attachments consist of multiple physical messages. The beginning of an attachment is recognized by having a message type of 100000. To identify this message, it will be referred to as the *attachment header*.

Layout of an attachment header message:

Note: All character strings are null terminated. Δ

```

byte[24] - header correlid (correlationid of this header
           message)
long      - original msg type (msg type provided by the
           sending application)
byte[24] - original msg correlid (msg correlationid
           provided by the sending application)
byte[24] - message correlid (generated correlationid for
           the msg)
int       - number of attachments
-----
int       - attachment type
           1 - SAS data set
           2 - External text file
           3 - External binary file
byte[24] - attachment correlid (correlationid associated
           with this attachment)
int       - length of qualifier 1
char[]    - qualifier 1
           external files: designates the sending file
           specification "FILENAME" or "FILEREf"
           dataset: designates the sending library name
int       - length of qualifier 2
char[]    - qualifier 2
           external files: designates the sending
           filename or fileref
           dataset: designates the sending member name
int       - length of attachment description
char[]    - attachment description
int       - user specified minor version number
int       - user specified major version number
-----
.
.
. repeat for each attachment in the list

```

Other physical messages are also needed to make up a complete attachment. These messages will be called subordinated messages, and they all have a message type of 100001.

The subordinate message that usually follows after the attachment header message is the application message. It can be filtered by using the message correlid located in the attachment header message. It contains the actual application generated message.

The attachment (external file or SAS data set) subordinate messages follow next. They contain the necessary information to recreate the file or data set.

To locate the subordinate message that contains the number of physical messages that are associated with this attachment, filter it by using the attachment correlid that is located in the attachment header message. The content of this message is a single

For data sets, the sequenced attachment correlated messages begin with a type identifier. This identifier signifies the type of information that is in this message. A type identifier of one signifies data set definitions. A type identifier of two signifies variable definitions. A type identifier of three signifies actual observations. Type identifiers four (indexes) and five (integrity constraints) usually have no use and can be ignored.

Note: All character strings are null terminated.

Layout of a data set definition message:

```

int      - type (data set definition=1)
int      - version (future)
long     - data set type length
char[]   - data set type
long     - data set label length
char[]   - data set label
long     - number of observations
long     - number of variables
long     - observation length
long     - length of compress
char[]   - compress
char     - reuse
long     - length of encrypt
char[]   - encrypt
long     - number of variables in sort key
long     - length of sort collating sequence
char[]   - sort collating sequence
short    - sort flags
int      - read password flag
byte[4]  - read password (encrypted)
int      - write password flag
byte[4]  - write password (encrypted)
int      - alter password flag
byte[4]  - alter password (encrypted)

```

Layout of a variable definition message:

```

int      - type (variable definition=2)
-----
long     - length of variable name
char[]   - variable name
long     - length of format name
char[]   - format name
long     - length of informat name
char[]   - informat name
long     - variable label length
char[]   - variable label
char     - variable type (1=double, otherwise character)
long     - variable length
long     - format field length
long     - format decimal
long     - informat field length
long     - informat decimal
char     - nsort

```

```

-----
.
.
. repeat for each variable

```

Note: Variable definitions might span multiple physical messages if definitions are larger than 32K.

Layout of an observation message:

```

int      - type (observation=3)
data     - the layout of data is defined by the variable
           definition above

```

Note: Observations might span multiple physical messages if they are larger than 32K.

Layout of an index message:

```

int      - type (index=4)
-----
long     - upercmx
long     - length of index/key name
char[]   - index/key name
long     - flags
long     - number of variables in the index/key
long     - variable lengths added together
char[]   - all variables null terminated
-----
.
.
. repeat for each index

```

Attachment Layout for TIB/Rendezvous

Overview of Attachment Layout for TIB/Rendezvous

An attachment consists of multiple physical messages. Each physical message has a specific message type. The field name of the first field in each message specifies the message type. Subsequent fields in the same message should use the same field name.

Data Message Layout

The following table shows the field name and purpose of the "MSG," or "DATA," type.

Note: The message type "MSG," or "DATA," can be retrieved without a field ID. All other message types must use a field ID. Δ

Table 7.1 Fields for the Data Message Layout

Field Name	Purpose
"MSG" or "DATA"	message data sent using a map

Data Set Attachment Layout

All attachments are required to have an attachment header and a "LST" message. However, not all messages are required. For example, many data sets do not use integrity constraints or indexes. If a data set does not contain the information that is contained in a message type, then the message is not required to be sent. The following table shows the field name, the purpose of each message type, and the order in which messages should be sent for a data set.

Table 7.2 Fields for the Data Set Attachment Layout

Field Name	Purpose
"HDR"	attachment header
"MSG" or "DATA"	message data sent using a map
"DAT"	data set descriptor
"VAR"	variable definition for data set
"ATO"	data set observations
"ATI"	data set index
"ATC"	data set integrity constraints
"LST"	last message of attachment

External File Attachment Layout

All attachments are required to have an attachment header and a "LST" message. However, not all messages are required. For each "FDC" record, send either a text file or a binary file. You can send more than one file in an attachment. Each file must have an "FDC" message and then one of the following:

- one or more "ATX" messages for the text files
- one or more "ATB" messages for the binary files

The following table shows the field name, the purpose of each message type, and the order in which messages should be sent for an external file.

Table 7.3 Fields for the External File Attachment Layout

Field Name	Purpose
"HDR"	attachment header
"FDC"	external file descriptor
"ATX"	text file attachment body
"ATB"	binary file attachment body
"LST"	last message of attachment

The following sections contain the description and required format for each message type.

Message Data - "MSG" or "DATA"

Note: The message type "MSG," or "DATA," can be retrieved without a field ID. All other message types must use a field ID. Δ

If any message data is to be sent along with an attachment, that message is sent following the attachment header. The field name for this type of message is either "MSG" or "DATA." The following sample is based on the map that is used in the code example provided on the Common Messaging Interface documentation.

The map for this message is described as: 'SHORT;LONG;DOUBLE;CHAR,,50'.

The following table shows the data values for the message data.

Table 7.4 Data Values for the Message Data

Parameter	Value
parm1	100;
parm2	9999;
parm3	9999.1234;
parm4	"ABCDEFGHIJKLMNOPQRSTUVWXYZ"; (blank padded to 50)

The following table shows the data type values for the message data.

Table 7.5 Data Types for the Message Data

Data Type	Value	Description
short	1	add with <code>tibrvMsg_AddI16()</code>
long	2	add with <code>tibrvMsg_AddI32()</code> as appropriate
double	3	add with <code>tibrvMsg_AddF64()</code>
string(char)	4	add with <code>tibrvMsg_AddString()</code>

The following table shows the layout of the message data.

Table 7.6 Fields for the Message Data

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	The number of data pieces to follow. For this example, the value of the field is "4".
2	int	tibrvMsg_AddI32()	The data type of the first data item. Because this data item is a short, the value for this field is "1".
3	short	tibrvMsg_AddI16()	The actual value of the first parameter being sent. In this case, because it is a short, the value is added to the message by using tibrvMsg_AddI16(). The value for this field is "100".

For each parameter that is sent, repeat fields 2 and 3 in the previous table, setting the appropriate values and incrementing the field IDs.

Attachment Header - "HDR"

The beginning of an attachment is recognized by processing the attachment header message. This message type is recognized by the "HDR" field name in all fields.

The following table shows the layout of the attachment header.

Note: All character strings are null terminated. Δ

Table 7.7 Fields for the Attachment Header

Field ID	Field Type	Function	Description
1	byte[24]	tibrvMsg_AddString()	header correlid: can be set to all blanks
2	unsigned long	tibrvMsg_AddU32()	reserved: set to 0
3	byte[24]	tibrvMsg_AddString()	reserved: set to all blanks
4	byte[24]	tibrvMsg_AddString()	message correlid: can be set to all blanks
5	integer	tibrvMsg_AddI32()	number of attachments in message (1 per data set)
6	integer	tibrvMsg_AddI32()	attachment type: value is <ul style="list-style-type: none"> <input type="checkbox"/> "1" for SAS data set. <input type="checkbox"/> "2" for an external text file <input type="checkbox"/> "3" for an external binary file
7	byte[24]	tibrvMsg_AddString()	attachment correlid: can be set to all blanks
8	int	tibrvMsg_AddI32()	length of qualifier 1 in field 9

Field ID	Field Type	Function	Description
9	char[]	tibrvMsg_AddString()	qualifier 1: <ul style="list-style-type: none"> <input type="checkbox"/> external files: designates the sending file specification "FILENAME" or "FILEREf" <input type="checkbox"/> data set: designates the sending library name
10	int	tibrvMsg_AddI32()	length of qualifier 2 in field 11
11	char[]	tibrvMsg_AddString()	qualifier 2: <ul style="list-style-type: none"> <input type="checkbox"/> external files: designates the sending filename or fileref <input type="checkbox"/> data set: designates the sending member name
12	int	tibrvMsg_AddI32()	length of attachment description
13	char[]	tibrvMsg_AddString()	attachment description
14	int	tibrvMsg_AddI32()	user-specified minor version number
15	int	tibrvMsg_AddI32()	user-specified major version number

For each attachment in the list, repeat fields 6-15 in the previous table, incrementing the field ID each time.

The attachment header is usually followed by the subordinate messages that contain the information necessary to re-create the data set or the external file.

Data Set Definition - "DAT"

The data set definition message is sent following the message data. This message type is recognized by the "DAT" field name in all fields.

The following table shows the layout of the data set definition.

Note: All character strings are null terminated. Δ

Table 7.8 Fields for the Data Set Definition

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	type of record is data set definition= 1
2	int	tibrvMsg_AddI32()	version information or 0
3	long	tibrvMsg_AddI32()	data set type length
4	char[]	tibrvMsg_AddString()	data set type
5	long	tibrvMsg_AddI32()	data set label length
6	char[]	tibrvMsg_AddString()	data set label
7	long	tibrvMsg_AddI32()	number of observations
8	long	tibrvMsg_AddI32()	number of variables
9	long	tibrvMsg_AddI32()	observation length

Field ID	Field Type	Function	Description
10	long	tibrvMsg_AddI32()	length of compress
11	char[]	tibrvMsg_AddString()	compress
12	char	tibrvMsg_AddString()	reuse ("R" or "E")
13	long	tibrvMsg_AddI32()	length of encrypt
14	char[]	tibrvMsg_AddString()	encrypt
15	long	tibrvMsg_AddI32()	number of variables in sort key
16	long	tibrvMsg_AddI32()	length of sort collating sequence or 1
17	char[]	tibrvMsg_AddString()	sort collating sequence or NULL
18	short	tibrvMsg_AddI16()	sort flags or 0
19	int	tibrvMsg_AddI32()	read password flag
20	byte[4]	tibrvMsg_AddOpaque()	read password (encrypted)
21	int	tibrvMsg_AddI32()	write password flag
22	byte[4]	tibrvMsg_AddOpaque()	write password (encrypted)
23	int	tibrvMsg_AddI32()	alter password flag
24	byte[4]	tibrvMsg_AddOpaque()	alter password (encrypted)
25	int	tibrvMsg_AddI32()	max_gen data set attribute

Variable Definition - "VAR"

The variable definition message is sent following the data set definition message. This message type is recognized by the "VAR" field name in all fields.

The following table shows the layout of the variable definition.

Note: All character strings are null terminated. Δ

Table 7.9 Fields for the Variable Definition

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	number of variables
2	int	tibrvMsg_AddI32()	type of record is variable definition=2
3	long	tibrvMsg_AddI32()	length of variable name
4	char[]	tibrvMsg_AddString()	name of variable
5	long	tibrvMsg_AddI32()	length of format name
6	char[]	tibrvMsg_AddString()	format name
7	long	tibrvMsg_AddI32()	length of informat name
8	char[]	tibrvMsg_AddString()	informat name
9	long	tibrvMsg_AddI32()	length of variable label
10	char[]	tibrvMsg_AddString()	variable label
11	char	tibrvMsg_AddString()	type of variable (1=numeric, 2=char)
12	long	tibrvMsg_AddI32()	length of variable

Field ID	Field Type	Function	Description
13	long	tibrvMsg_AddI32()	format field length
14	long	tibrvMsg_AddI32()	format decimal
15	long	tibrvMsg_AddI32()	informat field length
16	long	tibrvMsg_AddI32()	informat decimal
17	char	tibrvMsg_AddString()	nsort information

For each variable, repeat the fields in the previous table.

Note: If definitions are larger than 32K, then variable messages might span multiple physical messages. Δ

Data Set Observations - "ATO"

The data set observations message is sent following the variable definition message. This message type is recognized by the "ATO" field name in all fields.

The following table shows the layout of the data set observations.

Note: All character strings are null terminated. Δ

Table 7.10 Fields for Data Set Observations

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	number of observations
2	int	tibrvMsg_AddI32()	type of record is observation = 3
3	int	tibrvMsg_AddI32()	observation type (vtype)
4	double-observation	tibrvMsg_AddF64()	if observation type in field 3 is numeric
4	char[] - observation	tibrvMsg_AddString()	if observation type in field 3 is character

For each observation, repeat the fields in the previous table.

Note: If observations are larger than 32K, then they might span multiple physical messages. Δ

Data Set Index - "ATI"

If the data set index message is needed, the data set index message is sent following the data set observations message. This message type is recognized by the "ATI" field name in all fields.

The following table shows the layout of the index definition.

Note: All character strings are null terminated. Δ

Table 7.11 Fields for the Data Set Index

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	type of record is index = 4
2	int	tibrvMsg_AddI32()	number of records in this message
3	long	tibrvMsg_AddI32()	upercmx
4	long	tibrvMsg_AddI32()	length of index/key name
5	char[]	tibrvMsg_AddString()	index/key name
6	long	tibrvMsg_AddI32()	flags
7	long	tibrvMsg_AddI32()	number of variables in the index/ key
8	long	tibrvMsg_AddI32()	number of keys
9	char[]	tibrvMsg_AddString()	key name

For each key, repeat field 9 in the previous table. For each record, repeat fields 3-9 in the previous table.

Data Set Integrity Constraints - "ATC"

If the data set integrity constraints message is needed, then the data set integrity constraints message is sent following the data set index message. This message type is recognized by the "ATC" field name in all fields.

The following table shows the layout of the integrity constraints definition.

Note: All character strings are null terminated. Δ

Table 7.12 Fields for the Data Set Integrity Constraints

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	type of record is integrity constraint = 5
2	int	tibrvMsg_AddI32()	number of records in this message
3	long	tibrvMsg_AddI32()	IC type

Based on the value of field 3 in the previous table, use the following tables.

- If the field type is CHECK for field 3, then use the fields in the following table.

Table 7.13 Fields for the CHECK Field Type

Field ID	Field Type	Function	Description
4	long	tibrvMsg_AddI32()	max length for this IC
5	char[]	tibrvMsg_AddString()	name of IC
6	long	tibrvMsg_AddI32()	retval
7	long	tibrvMsg_AddI32()	total length
8	char[]	tibrvMsg_AddString()	list of wtnames

Field ID	Field Type	Function	Description
9	long	tibrvMsg_AddI32()	whlen
10	long	tibrvMsg_AddI32()	number of members in tree
11	byte[]	tibrvMsg_AddOpaque()	whbuf buffer

For each buffer, repeat field 11 in the previous table, incrementing the field ID each time.

- If the field type is not CHECK for field 3, then use the fields in the following table.

Table 7.14 Fields for Field Types Other than CHECK

Field ID	Field Type	Function	Description
4	long	tibrvMsg_AddI32()	max length for this IC
5	char[]	tibrvMsg_AddString()	name of IC
6	long	tibrvMsg_AddI32()	nvar - number of variables
7	long	tibrvMsg_AddI32()	number of NNAME records
8	char[]	tibrvMsg_AddString()	NNAME

For each NNAME value, repeat field 8 in the previous table, incrementing the field ID each time. Subsequent field IDs will increase from here.

- If the field type is not CHECK or FOREIGN KEY for field 3, then use the following table for field 9.

Table 7.15 Fields for Field Types Other than CHECK or FOREIGN KEY

Field ID	Field Type	Function	Description
9	long	tibrvMsg_AddI32()	filler value = 1

- If the field type is not CHECK but it is FOREIGN KEY for field 3, then use the fields in the following table.

Table 7.16 Fields for the FOREIGN KEY Field Type

Field ID	Field Type	Function	Description
9	long	tibrvMsg_AddI32()	total length of following fields
10	long	tibrvMsg_AddI32()	fkdel
11	long	tibrvMsg_AddI32()	fkup
12	long	tibrvMsg_AddI32()	pkng + 1
13	char[]	tibrvMsg_AddString()	pkname
14	char[8]	tibrvMsg_AddString()	pkfname libref
15	long	tibrvMsg_AddI32()	length of member name

Field ID	Field Type	Function	Description
16	char[]	tibrvMsg_AddString()	member name.
17	long	tibrvMsg_AddI32()	ICP attributes

For each record in the message, repeat field 3 and all subsequent fields in the previous tables.

External File Descriptor - "FDC"

This message type is recognized by the "FDC" field name in all fields. For each "FDC" record, send either a text file or a binary file. You can send more than one file in an attachment but the files must be either all text files or all binary files. Each file must have an "FDC" message and then one of the following:

- one or more "ATX" messages for the text files
- one or more "ATB" messages for the binary files

The following table shows the layout of the external file descriptor.

Table 7.17 Fields for the External File Descriptor

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	size of logical record
2	int	tibrvMsg_AddI32()	file size

Text File Attachment - "ATX"

This message type is recognized by the "ATX" field name in all fields. The following table shows the layout of the text file attachment body.

Table 7.18 Fields for the Text File Attachment

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	number of records in this message
2	long	tibrvMsg_AddI32()	length of data in field 3
3	char[]	tibrvMsg_AddString	file data

For each record in the message, repeat fields 2 and 3.

Binary File Attachment - "ATB"

This message type is recognized by the "ATB" field name in all fields. The following table shows the layout of the binary file attachment body.

Table 7.19 Fields for the Binary File Attachment

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	number of records in this message
2	long	tibrvMsg_AddI32()	length of data in field 3
3	tibrv_u8	tibrvMsg_AddOpaque	file data

For each record in the message, repeat fields 2 and 3.

Last Message of Attachment - "LST"

All attachments must end with an "LST" message. This message type is recognized by the "LST" field name in all fields. This message type contains a count of the number of messages sent for the attachment, not including itself.

The following table shows the layout of the last message.

Table 7.20 Fields for the Last Message

Field ID	Field Type	Function	Description
1	int	tibrvMsg_AddI32()	number of messages sent for attachment

Attachment Error Handling

Transfer Errors: Queue versus Point-To-Point

When sending a message to a message queue, all of the attachments (along with the message) are transferred to the queue when the `_SEND_` or `_SENDLIST_` is invoked. The attachments are stored at the domain server until they are fetched by a user. If an error occurs while you send the attachments to the queue, then neither the message nor the attachments are delivered to the queue. In this scenario, the return code from `_SEND_/_SENDLIST_` is set to `_SEATTXF`. This error indicates that neither the message nor the attachments were delivered because one or more errors occurred during attachment transfer.

When a message is sent using point-to-point messaging, only the attachment list, along with the message, is sent to the receiving side initially. The receiver is then responsible for determining which, if any, attachments should actually be transferred. Because the message is delivered to the receiver before any attachments are actually transferred, an error encountered during attachment transfer will not cause the `_SEND_` to terminate. If an error is encountered, then the current attachment transfer is terminated, but the remaining attachments selected to be received are sent to the receiving side. If any errors are encountered during attachment transfer, the return code from `_SEND_/_SENDLIST_` is set to `_SWATTXF`. This is only a warning indicating that the message was successfully sent, but one or more errors occurred during attachment transfer.

Accept Errors

When a message includes attachments, the receiver has the responsibility to determine which attachments are ultimately transferred, via the `_ACCEPT_ATTACHMENT_` method. If an error is encountered during attachment transfer, then the current attachment transfer is terminated, but the transfer continues with the next attachment in the *attachlist*. If any errors are encountered, then the return code from `_ACCEPT_ATTACHMENT_` is set to `_SWATTXF`. This is only a warning indicating that one or more errors occurred during attachment transfer.

Attachment Error Codes

To review what was mentioned above, a specific return code is set if an error is encountered during attachment transfer:

- When sending on a Cnction instance, `_SWATTXF` is returned.
- When sending on a Queue instance, `_SEATTXF` is returned.
- When accepting attachments on either a Queue or Cnction instance, `_SWATTXF` is returned.

When one of these scenarios occurs, the *attachlist* parameter passed to these methods is updated. An additional named item, *RC*, is added to each separate attachment list. The value of *RC* will be a numeric return code that can be used to determine what caused the error for this particular attachment transfer. The defined return codes include the following:

Input File Errors (error occurred on input file):

Value	Meaning
----	-----
20	general I/O error
21	libname does not exist
22	memname does not exist
23	invalid or missing password
24	invalid data set option value
25	invalid data set option name
26	general error parsing data set options
27	error parsing where stmt
28	bad physical filename
29	file in use
30	file does not exist
31	invalid authorization for external file
32	open failed for some reason other than mentioned above
33	error obtaining Integrity Constraints information
34	variable contains unsupported characters or is too long
35	key name contains unsupported characters or is too long

Output File Errors (error occurred on output file):

Value	Meaning
----	-----

```

80      general I/O error
81      libname does not exist
82      invalid or missing password
83      bad physical filename
84      file in use
85      file does not exist
86      invalid authorization for external file
87      open failed for some reason other than
        mentioned above
87      file already exists
88      engine does not support read passwords
89      engine does not support encryption

```

General/Misc. Errors:

Value	Meaning
----	-----
1	Out of memory error
2	Open of catalog by queue manager failed
3	Read error (of catalog) encountered by queue manager
4	Write error (of catalog) encountered by queue manager
5	Index create failure
6	Backwards compatibility error
7	Only SQL views supported

Example

In the following example, one attachment is accepted into a non-existent library name:

```

/* build one attachment list, att1 */
att1 = makelist();
rc = setnitemc(att1, 1, "ATTACH_ID");
rc = setnitemc(att1, "NOEXIST", "OUTLIB");
rc = setnitemc(att1, "A", "OUT");

/* insert att1 into the main attachment list, alist */
alist = makelist();
alist = insertl(alist, att1, -1);

/* accept the attachment */
call send(obj, "_ACCEPT_ATTACHMENT_", alist, rc);

/* if error, dump out attachment list to view rc */
if (rc NE 0) then
  call putlist(alist, "Attachment
list after accept:", 1);

```

After the accept method call, the attachment list *alist* has the following named items:

- Named item ATTACH_ID has a value of 1.
- Named item OUTLIB has a value of "NOEXIST."
- Named item OUT has a value of "A."
- Named item RC has a value of 81.

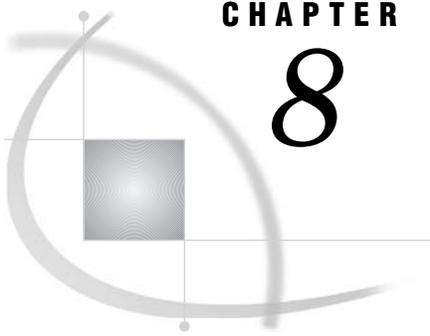
The error code list maps the return code of 81 into output library is nonexistent. Similarly, when the sender returns from the `_SEND/_SENDLIST_`, the *attachlist* parameter is updated with the *RC* named item to reflect that the attachment transfer failed.

```
att1 = makelist();
rc = setnitemc(att1, "SASUSER", "LIBNAME");
rc = setnitemc(att1, "NAMES", "MEMNAME");
rc = setnitemc(att1, "DATASET", "TYPE");
attachlist = makelist();
attachlist = insert1(attachlist, att1, -1);
call send(cnctionObj, "_SEND_", msgtype, attachlist,
rc, "Message One");
if (%sysrc(_SWATTXF) = rc) then do;
    call putlist(attachlist, "attachlist after send", -1);
end;
```

Assuming that the attachment was accepted by the receiving side as shown above, the attachment list, *attachlist*, is updated with the *RC* named item to reflect that the attachment transfer failed.

- Named item LIBNAME has a value of "SASUSER."
- Named item MEMNAME has a value of "NAMES."
- Named item TYPE has a value of "DATASET."
- Named item RC has a value of 81.

Again, the error code list maps the return code of 81 into output library is nonexistent.



CHAPTER

8

Common Messaging Interface Call Routines

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SAS CALL Routines for the Common Messaging Interface

This section documents all of the available CALL routines within the common messaging interface.

The beginning of the documentation for each CALL indicates which transports are supported. Within the CALL Routines and CALL documentation, the term MQSeries is used to refer to WebSphere MQ. When support for MQSeries (now known as WebSphere MQ) is noted, this includes both MQSeries Base/Server and MQSeries Client.

ABORT

Cancels prior work that has been done via a transaction object.

Transports supported: MQSeries, MQSeries-C, MSMQ

Syntax

```
CALL ABORT(transid, rc);
```

Arguments

transid

Numeric, input

Specifies the handle to a transaction object that is obtained from the BEGINTRANSACTION function.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

Details

For MQSeries, all transactions are associated with a particular queue manager. So when you cancel a unit of work that is associated with a particular queue manager, all work performed by that particular queue manager under synchpoint control is canceled at once. You can associate more than one transaction object with the same queue manager, but it is not a good practice. Under MSMQ, all transaction objects are autonomous.

Example

The following example cancels the processing of a transactional unit of work:

```
length msg $ 200;
length transid rc 8;
rc=0;
call abort(transid, rc);
if rc ^= 0 then do;
  put 'ABORT: failed';
  msg = sysmsg();
  put msg;
end;
else put 'ABORT: succeeded';
```

ACCEPTATTACHMENT

Accepts an attachment by recreating it on the local machine.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL ACCEPTATTACHMENT(*qid*, *attachid*, *qual1*, *qual2*, *rc*);

Arguments

qid

Numeric, input

Specifies the handle of an open queue that is obtained from a previous OPENQUEUE function call.

attachid

Numeric, input

Specifies an attachment identifier that is obtained from a previous GETATTACHMENT function call.

qual1

Character, input

Specifies the first attachment qualifier. If this is an external file attachment, then this qualifier designates the file specification that is used to receive it (either

FILENAME or FILEREF). Otherwise, this qualifier designates the receiving library name.

qual2

Character, input

Specifies the second attachment qualifier. If this is an external file attachment, then this qualifier designates the receiving filename or fileref. Otherwise, this qualifier designates the receiving member name.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYMSG() in order to obtain a textual description of the return code.

Details

For information about exception processing when you use attachments, see “Attachment Error Handling” on page 201.

Example

This example accepts attachments from a message and stores them in the file d:\myexternalfile.tmp.

```
length msg $ 200;
length qid lastflag attachid rc 8;
length type $ 13;
length qual1 qual2 $ 80;
length desc $ 80;
length minor major 8;

next:
  rc=0;
  lastflag=0;
  attachid=0;
  type='';
  qual1='';
  qual2='';
  desc='';
  minor=0;
  major=0;
  call getattachment(qid, lastflag, attachid, type,
    qual1, qual2, rc, desc, minor, major);
  if rc ^= 0 then do;
    put 'GETATTACHMENT: failed';
    msg = sysmsg();
    put msg;
  end;
  else do;
    put 'GETATTACHMENT: succeeded';
    put 'Attachment type is ' type;
    if type eq 'EXTERNAL_TEXT' OR type eq
      'EXTERNAL_BIN' then do;
      put "Sender's " qual1 " was " qual2;
```

```

/* accept/receive the external attachment */
call acceptattachment(qid, attachid, 'filename',
  'd:\myexternalfile.tmp', rc);
if rc ^= 0 then do;
  put 'ACCEPTATTACHMENT: failed';
  msg = sysmsg();
  put msg;
end;
else
  put 'ACCEPTATTACHMENT: succeeded';
end;
else do;
  put "Sender's library name was ' qual1";
  put "Sender's member name was ' qual2";

/* accept/receive the library/member */
libname tmp 'd:\tmp';
call acceptattachment(qid, attachid,
  'tmp', 'test', rc);
end;

if lastflag eq 0 then goto next;

```

BEGINTRANSACTION

Begins transaction processing by creating a transaction object.

Transports supported: MQSeries, MQSeries-C, MSMQ

Syntax

CALL BEGINTRANSACTION(*transid*, *tid*, *rc*);

Arguments

transid

Numeric, output

Returns a handle to a transaction object that is generated for committing and canceling transactional processing, as well as freeing the resources that are associated with the transaction object.

tid

Numeric, input

Specifies the transport handle that is obtained from the INIT function.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

Details

The created transaction object is used to commit or cancel prior processing (SENDMESSAGE and RECEIVEMESSAGE calls) that use the transaction object as a message property. Transaction processing is supported only by the MQSeries, MQSeries-C, and MSMQ transports.

Example

The following example begins a transaction:

```
length msg $ 200;
length transid tid rc 8;
rc=0;
transid=0;
call begintransaction(transid, tid, rc);
if rc ^= 0 then do;
  put 'BEGINTRANSACTION: failed';
  msg = sysmsg();
  put msg;
end;
else put 'BEGINTRANSACTION: succeeded';
```

CLOSEQUEUE

Closes a message queue.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

```
CALL CLOSEQUEUE(qid,rc <, attr>);
```

Arguments

qid

Numeric, input

Specifies the handle of a queue that is obtained from a previous OPENQUEUE function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

attr

Character, input

Specifies a delete attribute. The following attributes are valid:

DELETE

Specifies that the queue is to be deleted after it successfully closes, but only if there are no messages on the queue. This attribute is supported with MQSeries only. It is not supported with MSMQ because there is no way to programmatically determine the depth of the queue. It is not supported with Rendezvous because Rendezvous handles this function internally.

DELETE_PURGE

Causes the queue to be deleted, even if the queue depth is greater than zero. This attribute is supported with MQSeries, MQSeries-C, MSMQ, and Rendezvous-CM. It is not supported with Rendezvous because Rendezvous handles this function internally. If you are using Rendezvous Certified Message Delivery, when you close a listener queue the default setting is for the sender to save messages for persistent messaging. If you do not want messages to be saved by the sender or do not want persistent messaging, specify the DELETE_PURGE attribute when you close the queue. Setting the DELETE_PURGE attribute is the same as setting the cancelAgreements argument on TIBRVCM_CANCEL(TRUE).

Example

The following example closes a queue:

```
length msg $ 200;
length qid rc 8;
rc=0;
call closequeue(qid, rc);
if rc ^= 0 then do;
  put 'CLOSEQUEUE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'CLOSEQUEUE: succeeded';
```

COMMIT

Commits prior work that has been done via a transaction object.

Transports supported: MQSeries, MQSeries-C, MSMQ

Syntax

CALL COMMIT(*transid*, *rc*);

Arguments

transid

Numeric, input

Specifies the handle to a transaction object that is obtained from the BEGINTRANSACTION function.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

Details

For MQSeries, all transactions are associated with a particular queue manager. So when you commit a unit of work that is associated with a particular queue manager, all work that is performed by that particular queue manager under synchpoint control is committed at once. You can associate more than one transaction object with the same queue manager, but it is not a good practice. Under MSMQ, all transaction objects are autonomous.

Example

The following example commits a transactional unit of work for processing:

```

length msg $ 200;
length transid rc 8;
rc=0;
call commit(transid, rc);
if rc ^= 0 then do;
  put 'COMMIT: failed';
  msg = sysmsg();
  put msg;
end;
else put 'COMMIT: succeeded';

```

DELETEALIAS

Deletes a transport or queue alias definition from the information repository.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL DELETEALIAS(*type, name, storage, rc*);

Arguments

type

Character, input

Specifies the type of alias that is to be deleted. The following types are valid:

- TRANSPORT
- QUEUE

name

Character, input

Identifies the transport alias or queue alias that is to be deleted.

storage

Character, input

Specifies the location of the alias definition. The REGISTRY location is valid.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

Example

The following example deletes a queue alias from the SAS registry:

```
length msg $ 200;
length rc 8;
rc=0;
call deletealias('QUEUE', 'MYQUEUE', 'REGISTRY', rc);
if rc ^= 0 then do;
  put 'DELETEALIAS: failed';
  msg = sysmsg();
  put msg;
end;
else put 'DELETEALIAS: succeeded';
```

DELETMAP

Deletes a map data descriptor definition from the information repository.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL DELETMAP(*name*, *storage*, *rc*);

Arguments

name

Character, input

Identifies the map data descriptor that is defined by a previous SETMAP function call.

storage

Character, input

Specifies the location for the map definition. The REGISTRY location is valid.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

Example

The following example deletes a map data descriptor definition from the SAS registry:

```
length msg $ 200;
length rc 8;
rc=0;
call deletemap('MYMAP', 'REGISTRY', rc);
if rc ^= 0 then do;
  put 'DELETEMAP: failed';
  msg = sysmsg();
  put msg;
end;
else put 'DELETEMAP: succeeded';
```

DELETEMODEL

Deletes a dynamic creation queue model from the information repository.

Transports supported: MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL DELETEMODEL(*transport*, *name*, *storage*, *rc*);

Arguments

transport

Character, input

Specifies the transport that is associated with this model. MSMQ, Rendezvous, and Rendezvous-CM are the only valid transports for this CALL routine.

name

Character, input
Identifies the dynamic model.

storage

Character, input
Specifies the location for the model definition. The REGISTRY location is valid.

rc

Numeric, output
Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

Example

The following example deletes an MSMQ model queue definition from the SAS registry:

```
length msg $ 200;
length rc 8;
rc=0;
call deletemodel('MSMQ', 'MYMODEL', 'REGISTRY', rc);
if rc ^= 0 then do;
  put 'DELETEMODEL: failed';
  msg = sysmsg();
  put msg;
end;
else put 'DELETEMODEL: succeeded';
```

FREETRANSACTION

Frees a transaction object and its associated resources.

Transports supported: MQSeries, MQSeries-C, MSMQ

Syntax

CALL FREETRANSACTION(*transid*, *rc*);

Arguments***transid***

Numeric, input
Specifies the handle to a transaction object that is obtained from the BEGINTRANSACTION function.

rc

Numeric, output
Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

Example

The following example frees the resources that are associated with a transaction object:

```
length msg $ 200;
length transid rc 8;
rc=0;
call freetransaction(transid, rc);
if rc ^= 0 then do;
  put 'FREETRANSACTION: failed';
  msg = sysmsg();
  put msg;
end;
else put 'FREETRANSACTION: succeeded';
```

GETALIAS

Obtains the current definition of a transport alias or queue alias that is set by the SETALIAS function in the information repository.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL GETALIAS(*type*, *name*, *storage*, *rc*, *transport* <, *queue*>);

Arguments

type

Character, input

Specifies the type of alias. The following types are valid:

- TRANSPORT
- QUEUE

name

Character, input

Identifies the transport alias or queue alias that is set by the SETALIAS function.

storage

Character, input

Specifies the location for the alias definition. The REGISTRY location is valid.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

transport

Character, output

Returns the transport name.

queue

Character, output

Returns the queue name.

Example

The following example obtains a queue alias in the SAS registry:

```
length msg $ 200;
length rc 8;
length transport queue $ 80;
rc=0;
transport='';
queue='';
call getalias('QUEUE', 'MYQUEUE', 'REGISTRY',
rc, transport, queue);
if rc ^= 0 then do;
  put 'GETALIAS: failed';
  msg = sysmsg();
  put msg;
end;
else do;
  put 'GETALIAS: succeeded';
  put 'Transport = ' transport;
  put 'Queue = ' queue;
end;
```

GETATTACHMENT

Gets attachment information that is associated with a particular message.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL GETATTACHMENT(*qid*, *lastflag*, *attachid*, *type*, *qual1*, *qual2*, *rc* <, *desc*<, *minor* <, *major*>>>);

Arguments

qid

Numeric, input

Specifies the handle of an opened queue obtained from a previous OPENQUEUE function call.

lastflag

Numeric, output

Indicates whether you have reached the last attachment in a message. Possible values are as follows:

0

Specifies that more attachments are to be presented.

1

Specifies that this is the final attachment.

attachid

Numeric, output

Returns an attachment identifier that is used with the ACCEPTATTACHMENT function call when this attachment is accepted.

type

Character, output

Returns the type of attachment. The following types are valid:

- EXTERNAL_TEXT
- EXTERNAL_BIN
- DATASET

qual1

Character, output

Returns the first attachment qualifier. If this is an external attachment, then this qualifier designates the file specification that is used to send it (either FILENAME or FILEREF). Otherwise, this qualifier designates the sending library name.

qual2

Character, output

Returns the second attachment qualifier. If this is an external attachment, then this qualifier designates the sending filename or fileref. Otherwise, this qualifier designates the sending member name.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

desc

Character, output

Returns a description of the attachment if the sender provides one. This parameter is optional.

minor

Numeric, output

Returns a user-specified minor version number. This parameter is optional.

major

Numeric, output

Returns a user-specified major version number. This parameter is optional.

Details

You can repeatedly call this function until the final attachment has been presented.

Note: To receive an attachment from outside of the SAS environment, you must know the layout of an attachment.

For more information, see the “Attachment Layout for WebSphere MQ and MSMQ” on page 188 and the “Attachment Layout for TIB/Rendezvous” on page 191. △

Example

The following example gets all of the attachment information from a message:

```
length msg $ 200;
length qid lastflag attachid rc 8;
length type $ 13;
length qual1 qual2 $ 80;
length desc $ 80;
length minor major 8;

next:
  rc=0;
  lastflag=0;
  attachid=0;
  type='';
  qual1='';
  qual2='';
  desc='';
  minor=0;
  major=0;
  call getattachment(qid, lastflag, attachid, type,
    qual1, qual2, rc, desc, minor, major);
  if rc ^= 0 then do;
    put 'GETATTACHMENT: failed';
    msg = sysmsg();
    put msg;
  end;
  else do;
    put 'GETATTACHMENT: succeeded';
    put 'Attachment type is ' type;
    if type eq 'EXTERNAL_TEXT' OR type eq
      'EXTERNAL_BIN' then do;
      put "Sender's " qual1 " was " qual2;

      /* process external file... */
      end;
    else do;
      put "Sender's library name was ' qual1;
      put "Sender's member name was ' qual2;

      /* process library member... */
      end;

    if lastflag eq 0 then goto next;
```

GETMAP

Obtains the current definition of a map data descriptor in the information repository.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL GETMAP(*name*, *storage*, *rc*, *descriptor*);

Arguments

name

Character, input

Identifies the map data descriptor that is defined by a previous SETMAP function call.

storage

Character, input

Specifies the location for the map definition. The REGISTRY location is valid.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

descriptor

Character, output

Returns a string that describes the layout of the data. The format of the descriptor is as follows:

```
"type,offset,length;type,offset,length;..."
```

where:

- type is the type of data (SHORT, LONG, DOUBLE, CHAR)
- offset is the offset from the beginning of the message which is the cursor location in the case of the PARSEMESSAGE routine
- length is the length of the data which is valid only for CHAR data type

Example

The following example obtains a map data descriptor definition in the SAS registry:

```
length msg $ 200;
length rc 8;
length descriptor $ 80;
rc=0;
descriptor='';
call getmap('MYMAP', 'REGISTRY', rc, descriptor);
if rc ^= 0 then do;
  put 'GETMAP: failed';
  msg = sysmsg();
  put msg;
end;
```

```

else do;
  put 'GETMAP: succeeded';
  put 'descriptor = ' descriptor;
end;

```

GETMODEL

For MSMQ, obtains a dynamic creation queue model from the information repository. For Rendezvous and Rendezvous-CM, obtains transport attributes.

Transports supported: MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL GETMODEL(*transport*, *name*, *storage*, *rc*, *props*, *value1*, <, *value2*, *value3*,...>)

Arguments

transport

Character, input

Specifies the transport that is associated with this model. MSMQ, Rendezvous, and Rendezvous-CM are the only valid transports for this CALL routine.

name

Character, input

Identifies the dynamic model.

storage

Character, input

Specifies the location for the model definition. The REGISTRY location is valid.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

props

Character, input

Identifies one or more properties to be queried.

values

Character or numeric, output

Identifies one or more queue properties to be queried. This parameter is a character string with each applicable output variable separated by a comma.

Details

You must associate a variable with each property that is identified by *props*.

For MSMQ, the following properties are valid:

```

AUTHENTICATE character
BASEPRIORITY numeric

```

JOURNAL character
 JOURNALQUOTA numeric
 LABEL character
 PRIVLEVEL character
 QUOTA numeric
 TRANSACTION character
 TYPE binary string

For Rendezvous and Rendezvous-CM, the following transport properties are valid:

DAEMON character
 NETWORK character
 SERVICE character

For Rendezvous-CM only, the following transport properties are valid:

CMNAME character
 LEDGER character
 RELAYAGENT character
 REQUESTOLD character
 SYNCLEDGER character

Example

The following example obtains an MSMQ model queue definition in the SAS registry:

```
length msg $ 200;
length rc 8;
length auth priv $ 10;
length label $ 80;
rc=0;
auth='';
priv='';
label='';
call getmodel('MSMQ', 'MYMODEL', 'REGISTRY', rc,
'AUTHENTICATE,PRIVLEVEL,LABEL', auth, priv, label);
if rc ^= 0 then do;
  put 'GETMODEL: failed';
  msg = sysmsg();
  put msg;
end;
else do;
  put 'GETMODEL: succeeded';
  put 'authenticate = ' auth;
  put 'privacy level = ' priv;
  put 'label = ' label;
end;
```

GETQUEUEPROPS

Gets information pertaining to a queue's properties and security.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

```
CALL GETQUEUEPROPS(qid, rc, ttype, pmask, depth, maxdepth, maxmsgl, ctime,
  desc<, inbox>);
```

Arguments

qid

Numeric, input

Specifies the handle to an open queue that is obtained from a previous OPENQUEUE function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

ttype

Character, output

Identifies the transport type of the queue. Possible values are as follows:

- MQSeries
- MQSeries-C
- MSMQ
- Rendezvous
- Rendezvous-CM

pmask

Numeric, output

Returns the property assertion mask that the queue accepts. This property is valid only for the MQSeries, MQSeries-C, and MSMQ transports. Possible values are as follows:

bit 0

In MSMQ, specifies that the queue only accepts authenticated messages.

bit 1

In MSMQ, specifies that the queue only accepts private messages.

bit 2

In MSMQ, specifies that the queue only accepts public messages.

bit 4

In MSMQ, specifies that the queue only accepts transactional messages. In MQSeries, bit 4 specifies that the QMgr supports synchpoint.

depth

Numeric, output

Returns the current depth of the queue.

maxdepth

Numeric, output

Returns the maximum depth that is configured for the queue. This property is valid only for the MQSeries, MQSeries-C, and MSMQ transports.

maxmsgl

Numeric, output

Returns the maximum length that is configured for the queue. This property is valid only for the MQSeries, MQSeries-C, and MSMQ transports.

ctime

Character, output

Returns the queue creation time stamp. This property is valid only for the MQSeries, MQSeries-C, and MSMQ transports.

desc

Character, output

Returns a description of the queue. This property is valid only for the MQSeries, MQSeries-C, and MSMQ transports.

inbox

Character, output

Returns the name of the private inbox created for a session opened with FETCHX. This property is valid only for the Rendezvous transports. This parameter is optional.

Details

If a transport does not support a particular property, then the routine returns -2 for numeric property values but does not change character property values.

Example

The following example obtains the properties of a queue:

```
length msg $ 200;
length qid rc 8;
length ttype $ 13;
length pmask depth maxdepth maxmsgl 8;
length ctime desc $ 80;

rc=0;
ttype='';
pmask=0;
depth=0;
maxdepth=0;
maxmsgl=0;
ctime='';
desc='';

call getqueueprops(qid, rc, ttype, pmask, depth,
  maxdepth, maxmsgl, ctime, desc);
if rc ^= 0 then do;
  put 'GETQUEUEPROPS: failed';
  msg = sysmsg();
  put msg;
end;
else do;
  put 'GETQUEUEPROPS: succeeded';
  put 'transport type = ' ttype;
  if ttype eq 'MQSERIES' then do;
    if pmask='1...'b then put 'Syncpoint is enabled';
    else put 'Syncpoint is disabled';
  end;
  else if ttype eq 'MSMQ' then do;
```

```

        if pmask='1'b then put 'Authenticated
            messages are required';
        if pmask='1.'b then put 'Private
            messages are required';
        else if pmask='1..'b then put 'Public
            messages are required';
        else put 'Privacy is optional';
        if pmask='1...'b then put 'Transactional
            messages are required';
        else put 'Transactional messages
            are not permitted';
    end;
    put 'depth = ' depth;
    put 'maxdepth = ' maxdepth;
    put 'maxmsgl = ' maxmsgl;
    put 'creation time = ' ctime;
    put 'description = ' desc;
end;

```

INIT

Initializes a particular transport. You must use the TERM CALL routine to terminate the transport after you have completed a session.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL INIT(*tid*, *tname*, *rc*);

Arguments

tid

Numeric, output

Returns the transport handle that is used to open a queue or to begin transaction processing.

tname

Character, input

Specifies the name of the transport that is initialized. The following transport names are valid:

- MQSERIES (trantab=SAS_trantab_override)
- MQSeries-C (trantab=SAS_trantab_override)
- MSMQ
- RENDEZVOUS
- RENDEZVOUS-CM
- alias that is defined in the information repository

Note: With the MQSeries transport, if you use SAS to perform the conversion instead of using an MQSeries conversion exit, then you can specify which TRANTAB to use for converting the application data. △

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

Details

The following transports are valid: MQSeries (MQSeries Base/Server), MQSeries-C (MQSeries Client), MSMQ (Microsoft Message Queue), RENDEZVOUS (TIBCO TIB/Rendezvous), and RENDEZVOUS-CM (TIBCO TIB/Rendezvous Certified Message Delivery). In addition, you can use a transport alias name that is defined in the information repository to indirectly specify one of the transports.

Example

The following example initializes an MQSeries Base/Server transport:

```
length msg $ 200;
length tid rc 8;
tid=0;
rc=0;
call init(tid, 'MQSERIES', rc);
if rc ^= 0 then do;
  put 'INIT: failed';
  msg = sysmsg();
  put msg;
end;
else put 'INIT: succeeded';
```

OPENQUEUE

Opens a message queue. You must use the CLOSEQUEUE CALL routine to close the message queue.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Note: For Rendezvous Certified Message Delivery (Rendezvous-CM), you must define a model definition for certified message delivery. Use the SETMODEL call to define a model definition.

Syntax

```
CALL OPENQUEUE(qid, tid, qname, mode, rc <, attr1 <, attr2>>);
```

Arguments

qid

Numeric, output

Returns the queue handle for the opened queue. This handle is used in subsequent calls to send, receive, and parse messages and attachments, and close the queue.

tid

Numeric, input

Specifies the transport handle that is obtained from the INIT function.

Note: If transport handle is set to 0, then *qname* is assumed to be a queue alias name that is defined in the information repository, and the transport is initialized (and terminated at close) automatically. △

qname

Character, input

Specifies the name of the queue to open.

The syntax for an MQSeries transport is:

```
MQSeries:QMgr:Queue
```

The syntax for an MSMQ transport is:

```
MSMQ: PathName | FormatName
```

The following PathName representations are valid:

- machineName\QueueName (public queue)
- machineName\QueueName;Journal (public queue's journal)
- machineName\PRIVATE\$QueueName (private queue)
- machineName\PRIVATE\$QueueName;Journal (private queue's journal)
- machineName\Journal (machine journal queue)
- machineName\DeadLetter (machine deadletter queue)
- machineName\DeadXACT (machine transaction deadletter queue)

Note: machineName can be substituted with "." to designate the local machine. △

The following FormatName representations are valid:

- PUBLIC=QueueGUID (public queue)
- PUBLIC=QueueGUID;Journal (public queue's journal)
- PRIVATE=machineGUID\QueueNumber (private queue)
- PRIVATE=machineGUID\QueueNumber;Journal (private queue's journal)
- DIRECT=AddressSpecification\QueueName (direct format for public queue)
- DIRECT=AddressSpecification\PRIVATE\$QueueName (direct format for private queue)

where AddressSpecification is *protocol:address* (for example, **tcp:10.26.1.177**).

Note: You can use direct format in certain situations. Consult MSMQ documentation for details.

You can also use a queue alias name that is defined in the information repository as the *qname* parameter. △

The syntax for a Rendezvous or Rendezvous-CM transport is:

```
SubjectName | InboxName
```

SubjectName

consists of one or more elements separated by dot characters (periods). The elements can represent a subject name hierarchy. For example:

```
RUN.HOME
RUN.for.Elected_office.President
```

InboxName

is generated by the Rendezvous software. The syntax is the same as *SubjectName*, but must begin with `_INBOX` as the first element.

Note: If an inbox name is specified, the name must have already been created and returned by another call. For example, a `RECEIVEMESSAGE` call might have returned an inbox name in its *respq* attribute.

When the queue is being opened for sending, wildcard characters ('*' and '>') are not allowed. △

mode

Character, input

Identifies the operational mode of the queue that is opened. You can use only one mode to open a queue.

The following modes for the MSMQ and MQSeries transports are valid:

DELIVERY

Enables messages to be sent to a queue

FETCH

Enables messages to be destructively retrieved

FETCHX

The same as **FETCH** except it ensures exclusive usage

BROWSE

Enables messages to be nondestructively retrieved.

The following modes for the Rendezvous and Rendezvous-CM transport are valid:

DELIVERY

enables messages to be sent to a queue.

FETCH

enables messages to be retrieved.

FETCHX

same as **FETCH** except used for point-to-point or private messages (using inboxes) instead of broadcast messages (using subject names). The *qname* property must be left blank (") on the open call. A private inbox name is generated and associated with the *qid*. To access this queue, retrieve the inbox name by using `GETQUEUEPROPS`. Use the value returned as the response queue value on send message calls when notifying a partner application of the private inbox name to send responses to. For Rendezvous-CM, if persistent messaging is not required, then you can use the **FETCHX** mode. The **FETCHX** mode should not be used with persistent messaging because inbox names do not survive transport invalidation.

REQUEST

enables request messages to be sent to a subject (queue) that is being monitored by a remote program that serves as an information supplier. The *qname* parameter should specify the name of the queue to which the request message is

to be sent. Any responses received arrive on the queue that is specified in the *respqueue* parameter of the SENDMESSAGE call.

REQUESTX

same as REQUEST except used for point-to-point or private messages (using inboxes) instead of broadcast messages (using subject names). The *qname* parameter should specify the name of the queue on which the request message is to be sent. Any responses received use the inbox name associated with the *qid*. This inbox name is created internally by Rendezvous when the *respqueue* parameter is initialized to null. For Rendezvous-CM, if persistent messaging is not required, then you can use the REQUESTX mode. The REQUESTX mode should not be used with persistent messaging because inbox names do not survive transport invalidation.

Note: Before any messages are sent with the Rendezvous transport, the queues that receive the messages must be running and must have a listener (that is, the queues must be opened for FETCH, FETCHX, REQUEST, or REQUESTX). Otherwise, data will be lost. Queues that are opened for REQUEST and REQUESTX automatically have their receiving (response) queues open to listen for incoming messages when the initial request is sent. △

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

attrs

Character, input

Specifies one or more attributes to be associated with the queue. Each attribute constitutes a separate parameter in the open call. The following attributes are valid:

POLL (Timeout=wait_period_in_seconds)

Allows you to specify how message reception is handled for this queue. By default, the timeout period is set to INFINITE and a receive is blocked until a message arrives. To override the default, specify POLL and the timeout period.

DYNAMIC (Model=model_name)

Signifies that the queue is to be dynamically created, and specifies a model name that is defined in the information repository, which specifies how to create the queue. For the MQSeries transport, the model is defined in the MQSeries configuration, not in the SAS information repository.

CLUSTER (CLUSTER=BIND(bind_type))

Allows for setting of open options that enables MQSeries to connect to clusters. This attribute is valid only for MQSeries. Values for *bind_type* can be:

OPEN

translates to MQOO_BIND_ON_OPEN

NOT_FIXED

translates to MQOO_BIND_NOT_FIXED

AS_Q_DEF

translates to MQOO_BIND_AS_Q_DEF

Example

The following example opens a queue for delivery by using an alias name:

```

length msg $ 200;
length qid tid rc 8;
/* MYQUEUE exists as a queue alias definition
in the SAS information repository. */
rc=0;
qid=0;
tid=0;
call openqueue(qid, tid, 'MYQUEUE',
'DELIVERY', rc, "POLL(Timeout=5)");
if rc ^= 0 then do;
  put 'OPENQUEUE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'OPENQUEUE: succeeded';

```

PARSEMESSAGE

Parses a message body that has been received.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL PARSEMESSAGE(*qid*, *cursor*, *rc*, *map*, *data*);

Arguments

qid

Numeric, input

Specifies the handle of an open queue that is obtained from a previous OPENQUEUE function call.

cursor

Numeric, input or output

Sets the cursor to zero in order to parse from the beginning. Upon return, the cursor is positioned at the next data location, according to the specified map.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

map

Character, input

Specifies the map data descriptor that is defined by a previous SETMAP function call.

data

Character or numeric, output

Identifies the data to be parsed from the internal receive buffer.

Example

The following example parses a message:

```
length msg $ 200;
length qid rc attchflg 8 event $ 10;
length msgtype 8 corrid $ 48 map $ 80;
length employee $ 20 id 8;
rc=0;
map='employeeerecord';
/* data descriptor defined in repository...
ie., "char,,20;double" */
cursor=0;
call parsemessage(qid, cursor, rc, map, employee, id);
if rc ^= 0 then do;
  put 'PARSEMESSAGE: failed';
  msg = sysmsg();
  put msg;
end;
else do;
  put 'PARSEMESSAGE: succeeded';
  put 'employee = ' employee;
  put 'id = ' id;
end;
```

RECEIVEMESSAGE

Receives a message and optional attachments from a queue.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

```
CALL RECEIVEMESSAGE(qid, rc, event, attchflg, props <, value1, value2,...< data1,
  data2,...>>);
```

Arguments***qid***

Numeric, input

Specifies the handle of an open queue that is obtained from a previous OPENQUEUE function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

event

Character, output

Contains a description of the event that occurs as a result of the message being received. Possible event types are:

DELIVERY

Specifies that the message was delivered.

NO_MESSAGE

Specifies that no message is on queue.

ERROR

Specifies that an error has occurred. This event results in a nonzero value for *rc*. You need to initialize this parameter to a length of at least 10 before making the call so that there is room for the value to be placed in the string. Otherwise, the message might be truncated.

attachflg

Numeric, output

Indicates whether an attachment is associated with the received message. Possible return values are as follows:

0

Specifies that no attachments are associated with this message.

1

Specifies that attachments are associated with this message. You can call GETATTACHMENT to receive the attachments.

props

Character, input

Identifies one or more message properties that are associated with the message that is received. This parameter is a character string. Each property is separated by a comma. The following receive message properties are valid for MQSeries:

- ACCOUNTINGTOKEN
- APPLIDENTITYDATA
- APPLORIGINDATA
- PUTAPPLNAME
- PUTAPPLTYPE

The following receive message properties are valid for MSMQ:

- ADMINQUEUE
- AUTHENTICATE
- DESCRIPTION
- SENDERCERT

The following receive message properties are valid for both MQSeries and MSMQ:

- CORRELATIONID
- FEEDBACK
- MAP
- MSGID
- MSGTYPE

- OPTIONS
- QUEUEDTIME
- RESPQUEUE
- TIMEOUT
- TRANSACTION
- USERID

The following receive message properties are valid for Rendezvous and Rendezvous-CM:

- MAP
- RESPQUEUE
- TIMEOUT

The following receive message properties are valid for Rendezvous-CM only:

- CERTIFIED
- RELAYAGENTACTION
- SENDERNAME

values

Character or numeric

Provides the values that are associated with each property that is specified via the *props* parameter. You must associate a value with each property that is identified with the *props* parameter. The property values can be an input, output, or both.

Descriptions and values for the received message properties are:

ACCOUNTINGTOKEN

Binary string, output

Specifies an MQSeries accounting token.

ADMINQUEUE

Character, output

Specifies an MSMQ administrator queue.

APPLIDENTITYDATA

Character, output

Specifies MQSeries application identity data.

APPLORIGINDATA

Character, output

Specifies MQSeries application origin data.

AUTHENTICATE

Character, output

Indicates MSMQ authentication enablement. Possible authenticate return values are as follows:

NO

Specifies that the message was not authenticated.

YES

Specifies that the message was authenticated.

CORRELATIONID

Binary string, input or output

Specifies a correlation identifier. For MQSeries and MSMQ transports, on input this property can be used for filtering purposes. However, do not try to filter with this property when you are receiving attachment messages. The original CORRELATIONID is not associated with the attachment header message,

although the original CORRELATIONID is embedded within the attachment header itself and will be presented accurately. This type of processing is needed because an attachment consists of multiple messages that must be uniquely identified. A CORRELATIONID that is set by the application is not guaranteed to be unique.

CERTIFIED

Character, output

Specifies a Certified Message (CM) indicator. Possible return values are as follows:

NO

Specifies that the message was received by the normal transport or the listener has not been certified.

YES

Specifies that the message was received within the certified delivery transport.

DESCRIPTION

Character, output

Specifies a message description.

FEEDBACK

Numeric, output

For MQSeries, specifies a feedback code. For MSMQ, specifies a class.

MAP

Character, input

Specifies a data map name.

MSGID

Binary string, input or output

Indicates the message identifier. On input, this property can be used for filtering purposes for both MQSeries and MSMQ transports.

MSGTYPE

Numeric, output

Indicates the message type.

OPTIONS

Character, input

Specifies the receive options. The following options are valid:

POSITIONFIRST

(MQSeries/MSMQ)

Indicates to reposition to the first message in the queue.

CONVERSION_EXIT

(MQSeries only)

Specifies to use the MQSeries conversion exit. Otherwise, SAS performs all necessary data conversion internally.

PUTAPPLNAME

Character, output

Indicates an MQSeries application name.

PUTAPPLTYPE

Character, output

Indicates an MQSeries application type.

QUEUEDTIME

Character, output

Indicates the time at which the message was queued.

RELAYAGENTACTION

Character, input

Specifies connect or disconnect actions for the relay agent. The following values are valid:

CONNECT

Indicates to connect to the relay agent before receiving messages and attachments.

DISCONNECT

Indicates to disconnect from the relay agent after all messages associated with the call have been processed. If an attachment is received, the disconnect call is issued after the **ACCEPTATTACHMENT** call has processed all of the messages associated with the attachment and before the call returns to the **DATA** step. If **ACCEPTATTACHMENT** is not called, then the connection is not closed. If a connection was made to the relay agent during the call and an error occurs, then the error causes a disconnect from the relay agent.

BOTH

Indicates to connect to the relay agent, receive all messages, then disconnect from the relay agent. If an attachment is received, the disconnect call is issued after the **ACCEPTATTACHMENT** call has processed all of the messages associated with the attachment and before the call returns to the **DATA** step. If **ACCEPTATTACHMENT** is not called, then the connection is not closed. If an error occurs in a call, then if a connection was made to the relay agent during the call, an error causes a disconnect from the relay agent.

RESPQUEUE

Character, output

Indicates the response queue name.

SENDERCERT

Character, output

Indicates the subject within received certificate (MSMQ).

SENDERNAME

Character, output

Indicates the name of the certified message (CM) transport used by the sender.

TIMEOUT

Numeric, input

Specifies the number of seconds the **RECEIVEMESSAGE** call should wait for a message to arrive before returning. A value of -1 resets the queue to a non-polling state, and the **RECEIVEMESSAGE** call will wait indefinitely for a message to arrive. If the **POLL** attribute was not specified on an **OPENQUEUE** call, using this option on a **RECEIVEMESSAGE** call turns the queue into a polling queue that does not wait indefinitely for a message to arrive. You can turn a polling queue into a non-polling queue that waits indefinitely by specifying '-1' as the value of the **TIMEOUT** property on a **RECEIVEMESSAGE** call. By setting a **TIMEOUT** value on a **RECEIVEMESSAGE** call, the **TIMEOUT** value for the current queue ID is set to the new value, and all subsequent **RECEIVEMESSAGE** calls will wait for the new timeout specified.

TRANSACTION

Numeric, input

Indicates the transaction object obtained from BEGINTRANSACTION.

USERID

Character, output

Indicates the user identifier who sent the message.

data

Character or numeric, output

When you issue RECEIVEMESSAGE, all data that is associated with a message is placed into an internal buffer. You can parse this data during the RECEIVEMESSAGE call with these optional parameters, or you can call PARSEMESSAGE at a later time to parse the data.

Example

The following example receives a message such as the one sent in the SENDMESSAGE example:

```
length msg $ 200;
length qid rc attchflg 8 event $ 10;
length msgtype 8 corrid $ 48 map $ 80;
length employee $ 20 id 8;

rc=0;

corrid='';
/* no filtering */
map='employeerecord';
/* data descriptor defined in repository...
   for example, "char,,20;double" */

call receivemessage(qid, rc, event, attchflg,
  'MSGTYPE,CORRELATIONID,MAP', msgtype, corrid,
  map, employee, id);
if rc ^= 0 then do;
  put 'RECEIVEMESSAGE: failed';
  msg = sysmsg();
  put msg;
end;
else do;
  put 'RECEIVEMESSAGE: succeeded';
  put 'Event = ' event;
  if event eq 'DELIVERY' then do;
    put 'Message has been delivered';
    if attchflg eq 1 then do;
      put 'Attachment(s) are associated
with this message';
      /* process attachments...*/
    end;

    put 'employee = ' employee;
    put 'id = ' id;
  end;
end;
```

SENDMESSAGE

Sends a message and optional attachments to a queue.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

```
CALL SENDMESSAGE(qid, rc, props <, value1, value2,...<, data1, data2,...>>);
```

Arguments

qid

Numeric, input

Specifies the handle of an open queue that is obtained from a previous OPENQUEUE function call.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

props

Character, input

Identifies one or more message properties that affect the message being sent. This parameter is a character string with each applicable property separated by a comma. All values except MSGID are input to the SENDMESSAGE routine.

The following are valid send message properties for MQSeries:

- ACCOUNTINGTOKEN
- APPLIDENTITYDATA
- APPLORIGINDATA
- CODEDCHARSETID
- ENCODING
- FEEDBACK
- FORMAT
- PUTAPPLNAME
- PUTAPPLTYPE
- PUTDATE
- PUTTIME
- REPORT
- USERID

The following are valid send message properties for MSMQ:

- ACKNOWLEDGE
- ADMINQUEUE
- AUTHENTICATE
- DESCRIPTION

- ENCRYPT
- ENCRYPTALG
- HASHALG
- JOURNAL
- SENDERCERT

The following are valid send message properties for both MQSeries and MSMQ:

- ALLOWREADPROTECT
- ATTACHLIST
- CORRELATIONID
- MAP
- MSGID
- MSGTYPE
- PERSIST
- PRIORITY
- RESPQUEUE
- TIMEOUT
- TRANSACTION

The following are valid send message properties for Rendezvous and Rendezvous-CM:

- ATTACHLIST
- ALLOWREADPROTECT
- MAP
- RESPQUEUE

The following are valid send message properties for Rendezvous-CM only:

- ADDLISTENER
- ALLOWLISTENER
- DISALLOWLISTENER
- RELAYAGENTACTION
- TIMEOUT

values

Character or numeric, input or output

Provides values that are associated with the properties specified via the *props* parameter. You must associate a value with each property that is specified by *props*. All values except MSGID are input to the routine. For the MQSeries transport, MSGID is input and output. For the MSMQ transport, MSGID is only output. Descriptions and values for the send message properties are listed by transport, and the following *values* are valid:

ACCOUNTINGTOKEN

Binary string

MQSeries accounting token.

ACKNOWLEDGE

Character

MSMQ acknowledgment types. Possible acknowledge types are as follows:

NONE (Default)

Specifies that no acknowledgment messages are posted.

FULL_REACH_QUEUE

Specifies that positive or negative acknowledgments are posted, depending on whether the message reaches the queue.

FULL_RECEIVE

Specifies that positive or negative acknowledgments are posted, depending on whether the message is retrieved from the queue.

NACK_REACH_QUEUE

Specifies that negative acknowledgments are posted when a message cannot reach the queue.

NACK_RECEIVE

Specifies that negative acknowledgments are posted when a message cannot be retrieved from the queue.

ADDLISTENER

Character

Identifies one or more certified message names (CMNAMEs) of the listeners. This parameter is a character string with each CMNAME separated by a comma. Anticipates a listener (or listeners) for certified delivery agreement.

Note: If a listener is added, this feature applies to all future messages within the session. △

ADMINQUEUE

Character

Specifies the MSMQ administrator queue.

ALLOWLISTENER

Character

Identifies one or more certified message names (CMNAMEs) of the listeners. This parameter is a character string with each CMNAME separated by a comma. Allows listeners on the specified CMNAME to reinstate certified delivery. This feature overrides any DISALLOWLISTENER for listener CMNAME.

Note: If a listener is allowed, this feature applies to all future messages within the session. △

ALLOWREADPROTECT

Character

Specifies the value "YES". You must assert this property on read-protected data sets in order for that data set to be sent as an attachment. This ensures that the user realizes that the read password and encryption attributes are not preserved when this data set is sent as a message attachment. If this property is not applied, then the SENDMESSAGE call fails when the user tries to send a read protected data set, and an error is returned.

Note: This property is supported in SAS 8.1 and later. The password and encryption attributes are not preserved in the intermediate message format when the attachment is on a message queue. Because of this exposure, take care when sending password-protected or encrypted data sets as message attachments. △

APPLIDENTITYDATA

Character

Specifies the MQSeries application identity data.

APPLORIGINDATA

Character

Specifies the MQSeries application origin data.

ATTACHLIST**Character**

Specifies that a list of attachments is included with message. The format of the list is as follows:

```
"type, qual1, qual2, options;
type, qual1, qual2, options;..."
```

where the parameters are defined as follows:

type

Is the attachment type, which can be one of the following:

EXTERNAL_TEXT

Is an external text file.

EXTERNAL_BIN

Is an external binary file.

DATASET

Is a SAS data set.

qual1

Is a qualifier. For **EXTERNAL_TEXT** and **EXTERNAL_BIN** attachment types, this qualifier specifies the file specification type which can be one of the following:

- **FILENAME**
- **FILEREF**

For the **DATASET** attachment type, this qualifier specifies the library name.

qual2

Is a qualifier. For **EXTERNAL_TEXT** and **EXTERNAL_BIN** attachment types, this qualifier specifies the actual filename or fileref. For the **DATASET** attachment type, this qualifier specifies the member name.

options

Specifies optional attachment specifications. Multiple options must be separated by spaces. The following options are valid for all attachment types:

- **DESC**=attachment description
- **MINOR**=user specified minor version
- **MAJOR**=user specified major version

The following options are valid for the **DATASET** attachment type:

- **DATASET_OPTIONS**=data set options
- **WHERE**=WHERE clause
- **INDEX**=yes|no (default is yes so that indexes are sent)
- **IC**=yes|no (default is yes so that integrity constraints are sent)
- **ATTACH_VERSION**=VERSION_8

If the **ATTACH_VERSION** option is specified and value=**VERSION_8**, then the data set is sent using the column types available in the data sets before SAS®9. Use this option if you might be sending data sets to another SAS session that is running SAS 8.2 or earlier.

If the **ATTACH_VERSION** option is omitted or if any other value is specified, then the full data set, including all new types, is sent.

AUTHENTICATE

Character

Specifies MSMQ authentication enablement. Possible authenticate types are as follows:

NO (default)

Specifies that no authentication is necessary. The message is not signed.

YES

Specifies that the message is signed and authenticated by the destination queue manager.

CODEDCHARSETID

Numeric

Specifies the MQSeries coded character set.

CORRELATIONID

Binary string

Specifies the correlation identifier.

DESCRIPTION

Character

Specifies the Message description.

DISALLOWLISTENER

Character

Specifies one or more certified message names (CMNAMEs) of the listeners. This parameter is a character string with each CMNAME separated by a comma. It cancels certified delivery to listeners with the specified CMNAME.

Note: If a listener is disallowed, this feature applies to all future messages within the session. △

ENCODING

Numeric

Specifies MQSeries data encoding.

ENCRYPT

Character

Specifies MSMQ encryption enablement. Possible encryption types are as follows:

NO (Default)

Specifies that the message is to be sent as clear-text.

YES

Specifies end-to-end encryption of the message body.

ENCRYPTALG

Character

Specifies the MSMQ encryption algorithms. The following choices are valid:

RC2 (default)

RC4

FEEDBACK

Numeric

Specifies MQSeries feedback code.

FORMAT

Character

Specifies MQSeries format name.

HASHALG

Character

Specifies MSMQ hash algorithms. Possible hash types are as follows:

- MD2
- MD4
- MD5 (default)

JOURNAL

Character

Specifies MSMQ journaling. Possible journal types are as follows:

NO (default)

Specifies that the message is not kept in the originating machine's journal queue.

YES

Specifies that the message is kept in the originating machine's journal queue.

DEADLETTER

Specifies that the message is kept in a dead letter queue if it cannot be delivered.

MAP

Character

Specifies the data map name.

MSGID

Binary string

Specifies the message identifier.

MSGTYPE

Numeric

Specifies the message type.

PERSIST

Character

Specifies message persistence. Possible persist types are as follows:

NO

Indicates that the message is not persistent (default).

YES

Indicates that the message is persistent.

PRIORITY

Numeric

Specifies message priority.

PUTAPPLNAME

Character

Specifies MQSeries application name.

PUTAPPLTYPE

Numeric

Specifies MQSeries application type.

PUTDATE

Character

Specifies MQSeries put date.

PUTTIME

Character

Specifies MQSeries put time.

RELAYAGENTACTION

Character

Specifies the connect and disconnect actions for the relay agent. The following values are valid:

CONNECT

Indicates to connect to the relay agent before sending messages and attachments.

DISCONNECT

Indicates to disconnect from the relay agent after all messages associated with the call have been processed. The disconnect happens at the end of the call before the call returns to the DATA step.

BOTH

Indicates to connect to the relay agent, send all messages, and then disconnect from the relay agent. The disconnect happens at the end of the call before the call returns to the DATA step.

REPORT

Character

Specifies the MQSeries reporting types. Possible report types are as follows:

NONE

Specifies that no reports are required.

PASS_CORREL_ID

Specifies to pass a correlation identifier.

PASS_MSG_ID

Specifies to pass a message identifier.

COA

Specifies that confirmation-on-arrival reports are required.

COA_WITH_DATA

Specifies that confirmation-on-arrival reports with data are required.

COA_WITH_FULL_DATA

Specifies that confirmation-on-arrival reports with full data are required.

COD

Specifies that confirmation-on-delivery reports are required.

COD_WITH_DATA

Specifies that confirmation-on-delivery reports with data are required.

COD_WITH_FULL_DATA

Specifies that confirmation-on-delivery reports with full data are required.

EXPIRATION

Specifies that expiration reports are required.

EXPIRATION_WITH_DATA

Specifies that expiration reports with data are required.

EXPIRATION_WITH_FULL_DATA

Specifies that expiration reports with full data are required.

EXCEPTION

Specifies that exception reports are required.

EXCEPTION_WITH_DATA

Specifies that exception reports with data are required.

EXCEPTION_WITH_FULL_DATA

Specifies that exception reports with full data required.

DISCARD_MSG

Specifies to discard message if it is undeliverable.

RESPQUEUE

Character

Specifies the response queue name.

Note: If this attribute is specified with an empty string value ("") when using a Rendezvous or Rendezvous-CM queue that was opened using REQUESTX mode, the generated inbox name will be sent. If another name is specified, it will be used instead. △

SENDERCERT

Character

Specifies the MSMQ certificate store name that is used in order to search for external certificates. "MY" is typically specified. This results in a search of the current user's certificates with their associated private keys. For example, if "MY" is used, the corresponding registry entry is

```
HKEY_CURRENT_USER\Software\Microsoft\SystemCertificates\MY
```

TIMEOUT

Numeric

Specifies the timeout value in seconds.

For Rendezvous-CM, specify this timeout as the length of time this message is to be sent using certified message delivery.

TRANSACTION

Numeric

Specifies the transaction object that is obtained from BEGINTRANSACTION.

USERID

Character

Specifies the MQSeries user identifier.

data

Character or numeric, input

Specifies the individual pieces of data that are sent with the message.

Details

If you intend to send attachments, use a queue that supports transactional processing. In this way, all messages associated with a failed attachment can be backed out if any part of the attachment processing fails. The IBM MQSeries queue manager supports the synchpoint function. An MSMQ queue is a transactional queue. For information about exception processing when using attachments, see "Attachment Error Handling" on page 201.

Before any messages are sent with the TIB/Rendezvous transport, the queues that receive the messages must be running and must have a listener (that is, the queues must be opened for FETCH, FETCHX, REQUEST, or REQUESTX). Otherwise, data will be lost. Queues that are opened for REQUEST and REQUESTX automatically have their receiving (response) queues open to listen for incoming messages.

Note: If you are sending certified messages by using Rendezvous-CM, and plan to close the sending queue immediately after sending the message, then you might want to put a `sleep()` call in to sleep for a couple of seconds. This delay allows the Certified Delivery Agreement to be established between the sending transport and the receiving transport. This delay can also occur when a listener is first opened to receive certified messages. △

Example

The following example sends an employee name and ID with records attached:

```
length msg $ 200;
length qid rc 8;
length msgtype 8 corrid $ 48 alist $ 80;
length employee $ 20 id 8;

rc=0;

/* message properties */
msgtype=1;
corrid='0102030405060708090A0B0C0D0E0F';
alist='DATASET,EMPLOYEE,RECORDS,
      DESC=employee records for John Doe';

/* message data */
employee='John Doe          ';
id=9999;

call sendmessage(qid, rc,
  'MSGTYPE,CORRELATIONID,ATTACHLIST',
  msgtype, corrid, alist, employee, id);
if rc ^= 0 then do;
  put 'SENDMESSAGE: failed';
  msg = sysmsg();
  put msg;
end;
else put 'SENDMESSAGE: succeeded';
```

SETALIAS

Defines a transport or queue alias in the information repository.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL SETALIAS(*type, name, storage, rc, transport <, queue>*);

Arguments

type

Character, input

Specifies the type of alias to be defined. The following types are valid:

- TRANSPORT
- QUEUE

name

Character, input

Identifies the transport alias or queue alias that is assigned.

storage

Character, input

Specifies the location for the alias definition. The REGISTRY location is valid.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

transport

Character, input

Identifies the name of the transport. The following transports are valid:

- MQSERIES (trantab=SAS_trantab_override)
- MQSeries-C (trantab=SAS_trantab_override)
- MSMQ
- RENDEZVOUS
- RENDEZVOUS-CM

Note: With the MQSeries transport, if you use SAS to perform the conversion instead of using an MQSeries conversion exit, then you can specify which TRANTAB to use for converting the application data. If the TRANTAB is not specified, SAS will use the session encoding information to convert the data. △

queue

Character, input

Identifies the name of the queue that is defined. This parameter is optional.

Note: This queue is valid only if a queue alias is being defined. △

Details

An alias provides a level of indirection that simplifies the programming interface by encapsulating information for all other programs. For details about administrator programs, see “Administrator Programs” on page 171.

Example

This example defines an MSMQ queue alias in the SAS registry.

```
length msg $ 200;
length rc 8;
```

```

rc=0;
call setalias('QUEUE', 'MYQUEUE', 'REGISTRY', rc,
'MSMQ', 'machine_name\queue_name');
if rc ^= 0 then do;
  put 'SETALIAS: failed';
  msg = sysmsg();
put msg;
  end;
else put 'SETALIAS: succeeded';

```

SETMAP

Defines a map data descriptor in the information repository.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL SETMAP(*name*, *storage*, *rc*, *descriptor*);

Arguments

name

Character, input
Identifies the map data descriptor that is assigned.

storage

Character, input
Specifies the location for the map definition. The REGISTRY location is valid.

rc

Numeric, output
Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

descriptor

Character, input
Describes the layout of the data within a message body. This parameter is a string that contains the data type, the offset (optional), and (for character data) the length of each SAS variable. This data is presented in the order in which it is passed to a SENDMESSAGE call and returned from a RECEIVEMESSAGE call. The *descriptor* has the following format:

```
"type,offset,length;type,offset,length;..."
```

where:

- type is the type of data (SHORT, LONG, DOUBLE, or CHAR).

- offset is the offset from the beginning of the message, which is the cursor location in the case of the PARSEMESSAGE routine. This parameter is optional.
- length is the length of the data, which is valid only for the CHAR data type.

Details

A map specifies the layout of the data within a message body. Maps can be used with the MQSeries, MQSeries-C, MSMQ, Rendezvous, or Rendezvous-CM transport when sending and receiving data.

Example

The following example defines a map data descriptor in the SAS registry:

```
length msg $ 200;
length rc 8;
rc=0;
call setmap('MYMAP', 'REGISTRY', rc,
'SHORT;LONG,2;SHORT;DOUBLE,6;CHAR,,50');
if rc ^= 0 then do;
  put 'SETMAP: failed';
  msg = sysmsg();
  put msg;
end;
else put 'SETMAP: succeeded';
```

SETMODEL

For the MSMQ transport, defines a dynamic creation queue model. For the Rendezvous transport, the SETMODEL call enables you to change one or more transport attributes from the default values. For the Rendezvous-CM transport, defines a model definition for certified message delivery.

Transports supported: MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL SETMODEL(*transport*, *name*, *storage*, *rc*, *props*, *value1* <, *value2*,...>)

Arguments

transport

Character, input

Specifies the transport that is associated with this model. MSMQ, Rendezvous, and Rendezvous-CM are the only valid transports for this CALL routine.

name

Character, input

Identifies the dynamic model or transport model that is assigned.

storage

Character, input

Specifies the location for the model definition. The REGISTRY location is valid.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

props

Character, input

Identifies one or more properties that the queue exhibits once created. This parameter is a character string. Each applicable property is separated by a comma. You must associate a value with each property that is identified by *props*.

values

Character or numeric, input

Inputs the values for each property that is specified. Use one of the following values for each of the properties listed in the *props* parameter.

AUTHENTICATE

Character

Specifies whether the queue accepts only authenticated messages. The following values are valid:

NONE (Default)

Specifies the queue accepts either authenticated or nonauthenticated messages.

ALWAYS

Specifies the queue always requires authenticated messages.

BASEPRIORITY

Numeric

Specifies a single base priority for all messages sent to a public queue. Values range from -32768 to 32767, where 32767 is the highest priority, and 0 is the default priority.

JOURNAL

Character

Specifies whether messages retrieved from the queue are also copied to its journal queue. The following values are valid:

NONE (default)

Indicates that messages that are removed from the queue are not stored in a journal.

ALWAYS

Indicates that messages that are removed from the queue are always stored in its journal queue.

JOURNALQUOTA

Numeric

Specifies the maximum size (in kilobytes) of the journal queue. The default size is infinite.

LABEL

Character

Specifies a description of the queue. The default is a blank label ("").

PRIVLEVEL

Character

Specifies the privacy level that is required by the queue. The following values are valid:

NONE

Specifies that the queue accepts only nonprivate (clear-text) messages.

BODY

Specifies that the queue accepts only private (encrypted) messages.

OPTIONAL (default)

Specifies that the queue accepts both private and nonprivate messages.

QUOTA

Numeric

Specifies the maximum size (in kilobytes) of the queue. The default size is infinite.

TRANSACTION

Character

Specifies whether the queue is a transactional queue or a nontransactional queue. The following values are valid:

NONE (default)

Indicates that the queue does not accept transactional operations.

ALWAYS

Indicates that all messages that are sent to the queue must be done through an MSMQ transaction.

TYPE

Binary string

Specifies the type of service that is provided by the queue. The value of the TYPE property is a universal unique identifier (UUID) character string that represents binary data. The default is NULL_GUID.

For Rendezvous and Rendezvous-CM, the following transport properties are valid:

SERVICE

Character

Specifies the service name or port number. If you specify a null value, the transport creation function looks for the service name "rendezvous" and uses 7500 if "rendezvous" is not found. The TIB/Rendezvous documentation strongly recommends that administrators define "rendezvous" as a service, especially if UDP port 7500 is already in use. For more information, consult the TIB/Rendezvous documentation.

NETWORK

Character

Specifies the network name, Host IP, host name, or other identifier of the network. For more information, see the TIB/Rendezvous documentation.

DAEMON

Character

Specifies the TCP socket number for a local daemon, or the remote host name and socket number for a remote daemon. For more information, consult the TIB/Rendezvous documentation.

Note: A model is not required if you are using default Rendezvous values. △

For Rendezvous-CM only, the following transport properties are valid:

CMNAME

Character

Specifies the reusable name of a certified message (CM) transport. This is the CM Correspondent name, which can be omitted if persistent correspondents are not required.

LEDGER

Character

Specifies the name of the file in which to store a file-based ledger. This property can be omitted if persistent correspondents are not required.

RELAYAGENT

Character

Specifies the name of the relay agent. If you use this property, then it must be configured by the Rendezvous administrator.

REQUESTOLD

Character

Indicates whether a persistent correspondent requires delivery of unacknowledged messages that were sent to a previous certified delivery transport with the same CMNAME. Possible types are as follows:

NO (default)

Specifies that the new CM transport does not require certified senders to retain unacknowledged messages. Certified senders can delete those messages from their ledgers.

YES

Specifies that the new CM transport requires certified senders to retain unacknowledged messages sent to this persistent correspondent. When the new CM transport begins listening to the appropriate subjects, the senders can complete delivery. It is an error to specify YES when CMNAME is null.

SYNCLEDGER

Character

Specifies how to synchronize the ledger to its storage medium. Possible types are as follows:

NO (default)

Specifies that the operating system writes changes to the storage medium asynchronously.

YES

Specifies that the operations updating the ledger file do not return until the changes are written to the storage medium.

Details

Dynamic models for MQSeries are defined within its own configuration.

Example

The following example defines an MSMQ model queue in the SAS registry:

```
length msg $ 200;
length rc 8;
rc=0;
```

```

/* private queue model */
call setmodel('MSMQ', 'MYMODEL', 'REGISTRY', rc,
'AUTHENTICATE,PRIVLEVEL,LABEL', 'ALWAYS',
'BODY', 'Private dynamic queue');
if rc ^= 0 then do;
  put 'SETMODEL: failed';
  msg = sysmsg();
  put msg;
end;
else put 'SETMODEL: succeeded';

```

TERM

Terminates a particular transport. If you initiate a transport with the INIT CALL routine, you must use the TERM CALL routine to terminate the transport after you have completed the session.

Transports supported: MQSeries, MQSeries-C, MSMQ, Rendezvous, Rendezvous-CM

Syntax

CALL TERM(*tid*, *rc*);

Arguments

tid

Numeric, input

Specifies the transport handle that is obtained from the INIT function.

rc

Numeric, output

Provides the return code from the CALL routine. If an error occurs, then the return code is nonzero. You can use the SAS function SYSMSG() in order to obtain a textual description of the return code.

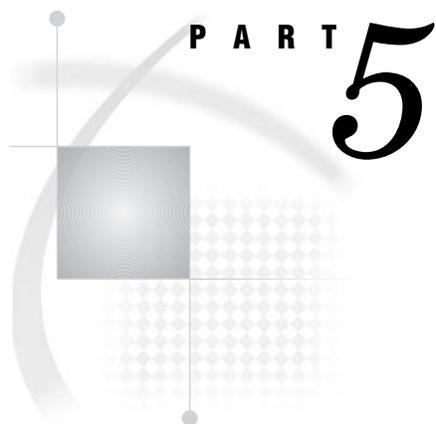
Example

The following example terminates a transport:

```

length msg $ 200;
length tid rc 8;
rc=0;
call term(tid, rc);
if rc ^= 0 then do;
  put 'TERM: failed';
  msg = sysmsg();
  put msg;
end;
else put 'TERM: succeeded';

```

Message Queue Polling

Appendix 1 **Configuring Message Queue Polling** 255

APPENDIX

1

Configuring Message Queue Polling

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Overview of Message Queue Polling

Message Queue Polling Concepts

Message queue polling is a SAS feature that enables you to monitor a message queue and start SAS programs to fulfill requests in the queue. You can configure message queue polling for WebSphere MQ only.

Message queue polling is performed by the *message queue polling server*. The message queue polling server is a specialized SAS server that monitors a queue and performs SAS processing on the messages in the queue. Message queue polling servers are managed by the Object Spawner. The spawner creates polling server sessions as needed, and balances the workload between the server sessions.

For more information about using message queue polling with WebSphere MQ, see “Using Message Queue Polling with WebSphere MQ” on page 13.

Overview of Configuring Message Queue Polling

To configure message queue polling, perform the following steps:

- 1 Configure your third-party messaging software.
- 2 Define a queue manager.
- 3 Define a message queue polling server.
- 4 Add the polling server to the object spawner definition.

Configure Your Third-Party Messaging Software

Before you can configure message queue polling, you must configure your third-party messaging software (IBM WebSphere MQ).

For more information about configuring WebSphere MQ, see “Configuring WebSphere MQ with the WebSphere MQ Explorer” on page 9.

Define a Queue Manager

To create a queue manager definition in the SAS Metadata Repository, perform the following steps:

- 1 In SAS Management Console, select the Server Manager and then select **Actions ► New Server**. The New Server Wizard appears.
- 2 Select **Queue manager for WebSphere MQ**, and then click **Next**.
- 3 Specify a name and an optional description. Click **Next**.
- 4 Define the queues that are managed by the queue manager.
To create a new queue, perform the following steps:
 - a Click **New**. The New Queue window appears.
 - b Specify a name and an optional description.
 - c Click **OK** to create the queue and return to the New Server Wizard.
- 5 Move the queues that you want to associate with the queue manager from the **Available items** pane to the **Selected items** pane. Click **Next**.
- 6 Specify the host name and port number for the queue manager (the **Authentication Domain** field is not used). Click **Next**.
- 7 Review the information that you have entered, and then click **Finish** to create the queue manager definition.

Define a Message Queue Polling Server

To create a message queue polling server definition in the SAS Metadata Repository, perform the following steps:

- 1 In SAS Management Console, select the Server Manager and then select **Actions ► New Server**. The New Server Wizard appears.
- 2 Select **Message Queue Polling Server** and then click **Next**.
- 3 Specify a name and an optional description. Click **Next**.
- 4 Specify your configuration settings for the following fields:

Command

specifies a command that is used to invoke SAS and process messages. You can modify the command to include invocation options.

In your SAS command or in the script that you use to invoke SAS, you must specify a SAS program file by using the `-SYSIN` option. The SAS program that you specify should contain messaging code to read messages from the queue and process the message contents.

Multiuser credentials

select the credentials that are used to start SAS server sessions. The credentials that you specify must have permissions to access the resources, such as data libraries, that your SAS program will access.

If you select **(None)**, then the object spawner's credentials are used to start the session.

Server machine list

specifies the machine where the polling server runs. The polling server must run on the same machine as an object spawner that it is associated with.

Queue

specifies the queue that the polling server monitors for messages.

- 5 Click **Advanced Options**. Specify the following options on the **Polling** tab:

Message threshold

specifies the maximum ratio of messages to server sessions. If the message threshold is exceeded, then the object spawner creates a new server session. The default value is 10 (10 messages to 1 server session).

For example, a polling server is configured with a message threshold value of 10. The message queue contains 21 messages, and two server sessions are running. Because the ratio of messages per server session (10.5) is greater than the threshold value (10), the object spawner creates a new server session.

Queue polling timeout

specifies the interval (in seconds) at which the server checks the depth of the message queue. The default value is 10.

Maximum sessions

specifies the maximum number of server sessions that are running. If you specify 0, then an unlimited number of server sessions can be created. The default value is 1.

Minimum sessions

specifies the minimum number of server sessions that are running. The default value is 0.

Note: If you specify 0, then one server session is created when the object spawner is started. Also, the object spawner maintains at least one server session if there are any messages in the queue. Δ

Queue polling process timeout

specifies the time (in seconds) to wait for the server sessions to end when the object spawner is shutting down. If you specify a value that is greater than zero, and any server sessions are still running after the time has elapsed, then the spawner terminates the sessions. If you specify 0, then there is no time limit for the server sessions to end. The default value is 0.

It is recommended that you use the default value of 0. Make sure that the code that is run by your server sessions checks for stop messages. See "Checking for Stop Messages" on page 14.

Note: If you specify a value that is greater than zero, then the spawner log might contain an error message, "Failed to locate the server indicated in the kill request" for each server session that ended normally. These messages do not indicate a problem. Δ

Note: If you specify a value that is greater than zero, then the spawner always waits the full timeout period when shutting down. For example, if you specify 30 seconds as the timeout value, then the spawner always waits 30 seconds to shut down, even if all of the server sessions end before 30 seconds.

If a spawner manages multiple polling servers, then the polling servers are shut down sequentially. The time delay for shutting down the spawner is cumulative. Δ

- 6 On the **WebSphere Options** tab, specify whether the MQ Server interface is used for monitoring the queue depth. If you choose to use the MQ Server interface, then the object spawner and the queue manager must be on the same machine.

Note: If you do not choose the Server interface, then the connection to the remote queue manager must be defined on the object spawner machine. For more information, see “Define the Queue Manager Connection on the Client Machine” on page 11. Δ

Click **OK** to return to the New Server Wizard, and then click **Next**.

- 7 Review your server settings, and then click **Finish** to create the server definition.

Add the Polling Server to the Object Spawner Definition

To assign a polling server to the object spawner definition, perform the following steps:

- 1 In SAS Management Console, expand the Server Manager, and then locate the object spawner that you want to modify.
- 2 Select **File ► Properties** to open the Properties dialog box for the spawner.
- 3 On the **Servers** tab, move the polling server from the **Available servers** pane to the **Selected servers** pane.
- 4 Click **OK** to save your changes and return to the Server Manager.
- 5 If the spawner is running, then refresh the spawner metadata by performing the following steps:
 - a Expand the spawner definition and select the host name.
 - b Select **Actions ► Refresh Spawner** to refresh the spawner metadata.

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