

Kofax Communication Server

Tandem Server Technical Manual

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The logo for Kofax, consisting of the word "KOFAX" in a bold, blue, sans-serif font.

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Chapter 1

Preface

Similar to the TS85 hardware status box, the TC/Status (status agent) prevents both halves of a tandem system from being desynchronized. Desynchronization would occur if both servers operated independently from each other in case of any error or operator intervention.

The status agent stores the status of both servers to allow any server of a tandem system to determine the status of the other server if the connection between the servers fails, or if the other server is switched off.

The status agent accepts one or two connections per master server using either network (TCP/IP), modem or simply a serial cable.

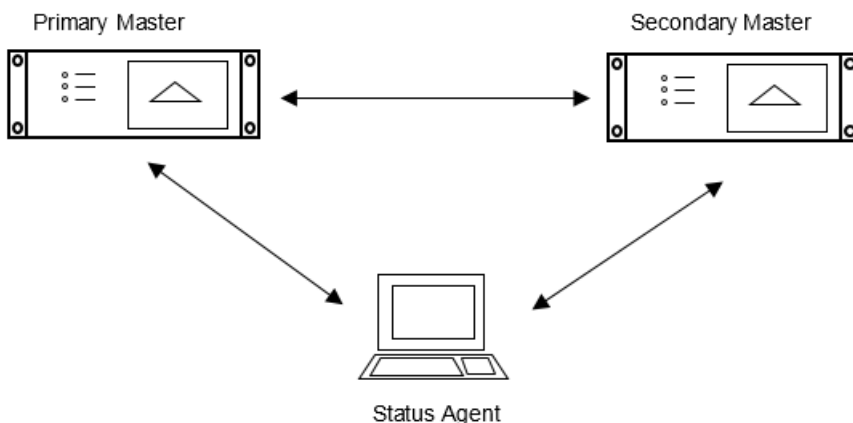
Under normal working conditions (both primary and secondary master running, LAN connection OK) the status agent has only a monitoring function. The connections to the status agent are checked regularly (the dial-up connection less frequently, and the check frequency is configurable) and operator messages are generated if any problem is detected.

In an error situation (such as a secondary master not running), the status agent is accessed to permanently store which half of the system (primary or secondary master) continued working. At startup of a master server, this information is accessed to prevent from a "desynchronized" state.

If the status agent is not operational or if all connections to the status agent fail, TCROSS will continue running, but the result may be the desynchronized state of primary and secondary master.

Note The *Tandem Server* is sometimes also called *Model 22x*, which was the former product name.

Operation Principle



In normal operation, the primary master is connected to the secondary master using the data link connection. The data link connection is the high bandwidth network connection between both masters used to transfer all data to the hard disks for both servers. In many cases, this high bandwidth network connection is realized by a dedicated LAN.

The disk and status data are always exchanged between both servers using the data link connection. In the case, there is a dedicated LAN for the data link and a second connection to the customers LAN. Only the dedicated LAN is important in terms of data exchange and error tolerance.

If the data link fails, no server is able to directly read the other server's status. This is also the case if one server is switched off.

To provide more redundancy and tolerance against loss of connection between both servers, an additional computer running the status agent is added to the system. The servers are connected to the status agent by at least one additional connection different from the LAN used by the data link.

During normal operation, a server gets the status directly from the other server without using the status agent. If the other server is not accessible for any reason, the status is read from the status agent.

Changes in the status on either side are immediately written to the status agent.

A status change during normal operation occurs if the data link between the servers is interrupted. This case prevents the primary master from copying the hard disk data to the secondary master's disk. After a short timeout, the primary master changes its state to "not mirrored." This status change is propagated to the status agent, before the primary master may continue writing disk data.

When a server tries to set the status "not mirrored," the status agent checks also its local copy of the other server's status for "not mirrored" in order to prevent a desynchronized state. Both servers with the "not mirrored" state means that both servers ran standalone and changed their hard disk data independently from each other.

To prevent this situation, the status agent reports an error to the server changing its state last. When a server encounters this error, it terminates.

This desynch detection mechanism is important only at server startup, before trying to write the first hard disk data. Only in this situation, it is possible for a master server to become "not mirrored" (the other server cannot be contacted) while the other server is already "not mirrored." During normal tandem operation, this can never occur.

Basically, the system is operable without the status agent (or a hardware status box). If a master server is not able to access the status agent, it continues working as if it had successfully set the status. Only an error message is generated in this case (TE..., Event Log).

Without the status agent, desynchronization is possible in case of a data link failure because there is no more checking against this condition.

To provide maximum security for the system, operation without a status agent (or status box) is not allowed except short time periods for maintenance.

Operating Restrictions

For proper working of a tandem system, the status agent has to be operated with all of the following conditions met:

- There is only a single status agent instance in a tandem system, which won't work with two status agent instances. This approach does not increase fault tolerance.
- The status agent runs on a separate server, which is physically different from the primary and secondary master. The status agent requires very few resources in terms of disk space, CPU and memory usage; therefore, it can be easily put onto any other server.
- From each master server, there must be at least one connection to the status agent that is independent of the data link connection used for data transfer between both master servers. This can be a second LAN connection, a modem connection via public phone lines, or a serial cable.

Monitoring

For the status agent, TCMON replaces the LED indicators of the TS85 status box. TCMON shows the status agent as the process TCSTATUS. TCSTATUS has three information lines containing the status of both every single master and the entire system. This process only displays the status. It is not possible to perform any maintenance actions such as clearing disks.

For maintenance, TCMON shows the message server's (the entire system) configuration such as the list of channels or the hierarchy of nodes. Within the hierarchy of nodes, nodes 1 and 2 contain the disks available in the system. In the case of desynchronization, TCMON allows clearing of one or both disks (see the *Kofax Communication Server Monitor User Manual*).



TCMON may run on any Windows computer that are allowed and able to access the servers and status agent.

Status Information

The status agent provides three lines of information containing the status of both servers and the entire system. This information is intended to replace the LED indicators of the hardware status box.

The following examples include status messages displayed for TCSTATUS.

Status display, normal operation:

```
Primary Master disk mirrored  
Secondary Master disk mirrored  
-> Normal, fault tolerant operation
```

Status display, failure of secondary master:

```
Primary Master disk active, not mirrored  
Secondary Master disk not up-to-date, may be synchronized  
-> Using only Primary Master disk (no fault tolerance)
```

Status display, update of secondary master:

```
Primary Master disk active, not mirrored  
Secondary Master disk being updated from primary master disk  
-> Working with Primary Master disk, establishing fault tolerance
```

Example of status display, desynch condition:

```
Primary Master disk not mirrored  
Secondary Master disk not mirrored  
-> Desynchronized, clear one disk to start update
```

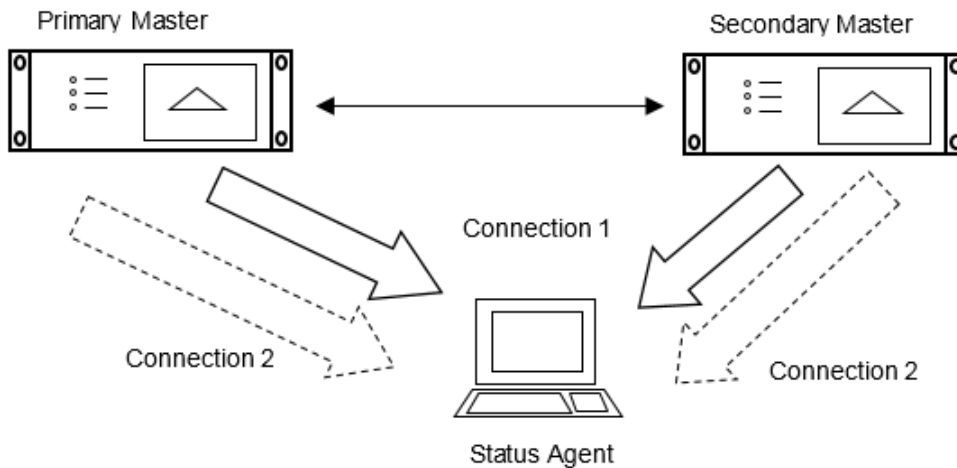
Example of status display, not initialized:

```
Primary Master disk state unknown  
Secondary Master disk state unknown  
-> Tandem Server not initialized
```

Chapter 2

Configuration

The software status agent is a computer running Windows, the TCSRV supervisor service and the status agent process TCSTATUS, which is started and controlled by TCSRV. The status agent does not require high processing power. It is possible to have the status agent together with TC/LINK processes or other KCS services as long as high availability and reliable connections to it can be ensured.



The status agent has one or two connections with each master server. One connection is the main connection and should be either LAN or WAN. The second is the optional backup connection and can be LAN, WAN, dial-up with modem or serial cable.

A number of possible hardware configurations are possible, with different types: main and backup.

For all hardware configurations, the following rules apply:

- At least one connection should always be LAN or WAN to provide fast access times for status updates and to allow monitoring of the status agent with TCMON.
- At least one connection has to be independent of the data link connection used for data transfer between both master servers. This can be a second LAN connection, a modem connection via public phone lines or a serial cable.

The two TCOSS servers and the status agent may be installed at three different sites. If the status agent is installed at the same site as one of the TCOSS servers, it should be placed near the primary master.

TCMON can be installed on any Windows computer. It should be installed on a computer that allows a LAN connection to all servers and the status agent.

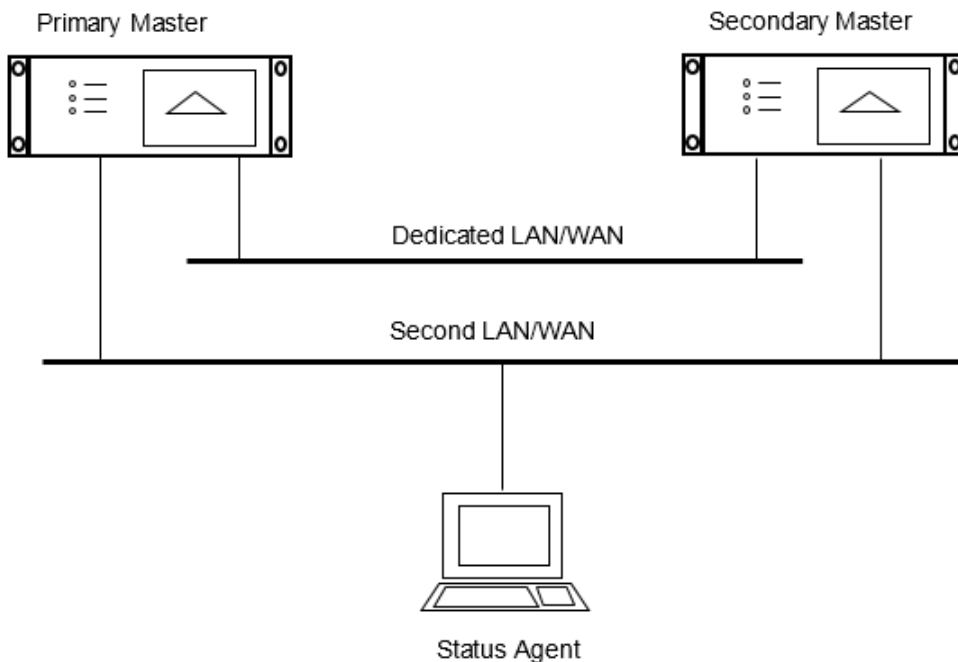
Installation Examples

This section provides installation examples.

Two Independent Networks

In this configuration, a second, independent LAN or WAN connection has to exist between both master servers and between the master servers and the status agent.

This configuration can be used if the customer's environment allows having two independent network connections between the master servers.



The dedicated LAN is a network connecting only the primary master and secondary master. No other devices are connected to it.

The second LAN can be any other network such as the customer's productive LAN environment.

TCMON can be run on any Windows computer.

Requirements

The second LAN has to be completely independent from the dedicated LAN to ensure availability of one LAN in the case the other fails.

Both LANs must not share common paths such as the same cable, routers, or switches. If it does, the system has a single point of failure that prevents fault tolerant operation.

Error Cases

Dedicated LAN fails:

The secondary master loses a connection to the primary master and restarts. At restart, it reads the status of the primary master from the status agent. The primary master continues working and changes its state to "not mirrored." The secondary master terminates to prevent desynchronization because the primary master is already "not mirrored."

Primary Master fails:

The secondary master loses connection to the primary master and restarts. At restart, it reads the status of the primary master from the status agent. It waits a certain time period for the primary master to become available. After this time, it starts standalone and sets itself to "not mirrored" because the status of the primary master reported by the status agent still is "mirrored".

Secondary Master fails:

The primary master loses connection and sets itself to "not mirrored.". Work continues after a short timeout for detecting unavailability of the secondary master and after it propagates the new status to the status agent.

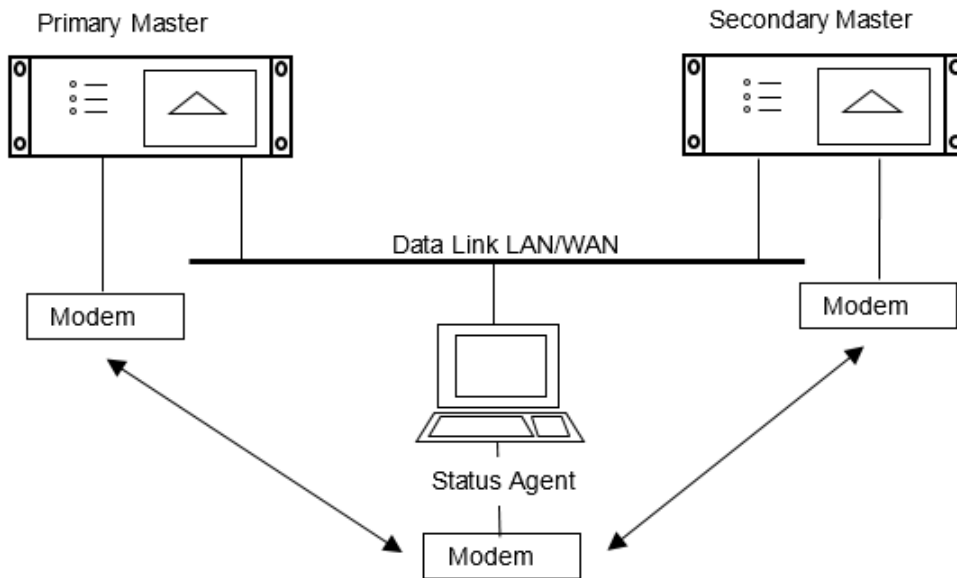
Status Agent or Second LAN fails:

A malfunction of the status agent or one of the connections to it is recorded as operator message and work continues uninterrupted.

Fault tolerance is reduced.

Network and Modems

In this configuration, only one LAN or WAN connection is used. This configuration is used if the customer's environment does not allow a second network connection. Additionally, the status agent is not placed near one of the master servers.



Because the status agent is connected to the Data Link LAN, an additional connection is necessary to provide redundancy. In case the data link connection fails, the backup connection via modems is used to access the status agent.

This configuration would also work if there were no network connection to the status agent (similar to the case [Two Independent Networks](#)). Nevertheless, we recommend that you have a network connection to the status agent to ensure fast access times by the master servers. In addition, the network connection allows a single instance of TCMON to be run on any Windows computer.

Note This is expected to be a rather seldom used configuration. In most cases, the status agent is placed near the primary master, in which case one of the following configurations is more appropriate.

Requirements

A separate dial-up phone line is required for the primary master, secondary master, and for the status agent installation. This requirement ensures that an outgoing call can be made at any time. (If the connection were made via a PBX, all public lines might be busy.)

Alternatively, all three modems may be connected to the same PBX, if it can be guaranteed that a connection can be established at any time.

Error Cases

LAN fails:

The secondary master loses the connection to the primary master and restarts. At restart, it reads the status of the primary master from the status agent using the modem connection. The primary master continues working and changes its state to "not mirrored." In addition, an operator message is generated that one connection to the status agent failed. The secondary master terminates to prevent desynchronization because the primary master is already "not mirrored."

Primary Master fails:

The secondary master loses the connection to the primary master and restarts. At restart, it reads the status of the primary master from the status agent. It waits a certain time period for the primary master to become available. After this time, it starts standalone and sets itself to "not mirrored." because the status of the primary master reported by the status agent still is "mirrored."

Secondary Master fails:

The primary master loses connection and sets itself to "not mirrored." Work continues after a short timeout for detecting unavailability of the secondary master and after it propagates the new status to the status agent.

Status Agent or Modem Lines fail:

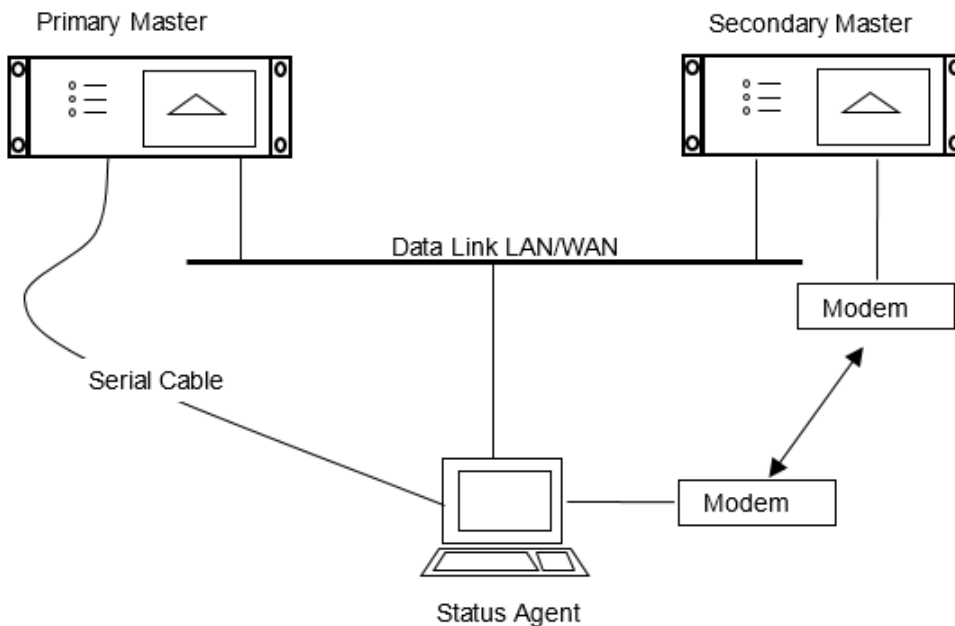
A malfunction of the status agent or one of the connections to it is recorded as an operator message and work continues uninterrupted.

Fault tolerance is reduced.

Network, Serial Cable and Modem

This configuration is a variation of [Network and Modems](#). The only difference is that the modem connection of the primary master is replaced by a serial cable to the status agent.

This configuration is used if the customer's environment does not allow a second network connection and the status agent can be placed near the primary master.



Because the status agent is connected to the Data Link LAN, an additional connection is necessary to provide redundancy. In case the data link connection fails, the primary master uses the backup connection

via serial cable and the secondary master uses the backup connection via modems to access the status agent.

This configuration would also work if there were no network connection to the status agent (similar to the case [Two Independent Networks](#)). Nevertheless, it is recommended to have a network connection to the status agent to ensure fast access times by the master servers. In addition, the network connection allows a single instance of TCMON to be run on any Windows PC.

Requirements

A separate dial-up phone line is required for the secondary master and for the status agent installation. This is to ensure that an outgoing call can be made at any time. (If the connection were made via a PBX, all public lines might be busy.)

Alternatively, both modems may be connected to the same PBX, if it can be guaranteed that a connection can be established at any time.

With this configuration, the status agent requires one additional COM port to be available for the serial connection to the primary master.

Error Cases

LAN fails:

The secondary master loses the connection to the primary master and restarts. At restart, it reads the status of the primary master from the status agent using the modem connection. The primary master continues working and changes its state to "not mirrored." In addition, an operator message is generated, indicating that one connection to the status agent failed. The secondary master terminates to prevent desynchronization because the primary master is already "not mirrored."

Primary Master fails:

The secondary master loses the connection to the primary master and restarts. At restart, it reads the status of the primary master from the status agent. It waits a certain time period for the primary master to become available. After this time, it starts standalone and sets itself to "not mirrored" because the status of the primary master reported by the status agent still is "mirrored."

Secondary Master fails:

The primary master loses the connection and sets itself to "not mirrored." Work continues after a short timeout for detecting unavailability of the secondary master, and after it propagates the new status to the status agent.

Status Agent or Modem Lines fail:

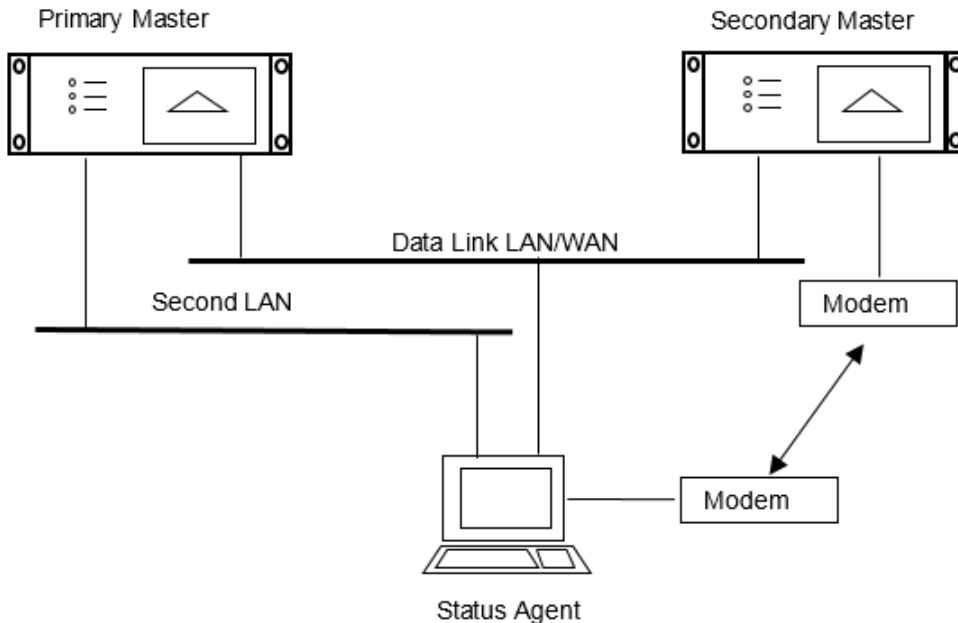
A malfunction of the status agent or one of the connections to it is recorded as an operator message, and work continues uninterrupted.

Fault tolerance is reduced.

Two Networks, Modem

This configuration is a variation of [Networks and Modems](#). The difference is that the modem connection of the primary master is replaced by a second LAN independent from the data link LAN/WAN.

This configuration is used if the customer's environment does allow an independent second network that is local to the site where both primary master and status agent are placed.



For the secondary master, the status agent is connected only to the Data Link LAN. Therefore, an additional connection is necessary to provide redundancy. In case the data link connection fails, the secondary master uses the backup connection via modems to access the status agent.

This configuration would also work if there were no network connection of the status agent to the data link LAN. Nevertheless, it is recommended to have this network connection to the status agent to ensure fast access times by the secondary master server. In addition, the network connection allows a single instance of TCMON to be run on any Windows PC.

Requirements

A separate dial-up phone line is required for the primary master and for the status agent installation. This requirement ensures that an outgoing call can be made at any time. (If the connection were made via a PBX, all public lines might be busy.)

The second LAN has to be completely independent from the data link LAN to ensure availability of one LAN, in the case the other fails.

Both LANs must not share common paths such as the same cable, routers, or switches. If it does, the system has a single point of failure that prevents fault tolerant operation.

Error Cases

Data Link LAN fails:

The secondary master loses the connection to the primary master and restarts. At restart, it reads the status of the primary master from the status agent using the modem connection. The primary master continues working and changes its state to "not mirrored." In addition, an operator message is generated, indicating that one connection to the status agent failed. The secondary master terminates to prevent desynchronization because the primary master is already "not mirrored."

Primary Master fails:

The secondary master loses the connection to the primary master and restarts. At restart, it reads the status of the primary master from the status agent. It waits a certain time period for the primary master to become available. After this time, it starts standalone and sets itself to "not mirrored" because the status of the primary master reported by the status agent still is "mirrored."

Secondary Master fails:

The primary master loses the connection and sets itself to "not mirrored." Work continues after a short timeout for detecting unavailability of the secondary master and after it propagates the new status to the status agent.

Status Agent, Modem Line or Second LAN fails:

A malfunction of the status agent or one of the connections to it is recorded as an operator message and work continues uninterrupted.

Fault tolerance is reduced.

TCOSS Configuration

Access to the status agent will be configured in a new **"StatusAgent"** section under the `"HKEY_LOCAL_MACHINE\SOFTWARE\TOPCALL\TCOSS"` subkey in the Windows registry.

ProcessName	REG_SZ	Status agent process name, default: "TCSTATUS"
AccessTimeout	REG_DWORD	Timeout (in seconds) for retries to reach status agent (default: 120s)

The details of the two connections to the status agent are set under a **"StatusAgent\Connection1"** and **"StatusAgent\Connection2"** subkey.

Type	REG_DWORD	Type of connection <ul style="list-style-type: none"> • 0 = not active • 1 = serial cable (hardware status box TS85, no longer supported) • 2 = modem (hardware status box TS85, no longer supported) • 3 = LAN using TCP/IP • 4 = LAN using named pipes (must not be used)
-------------	-----------	--

CheckCycle	REG_DWORD	Connection checked every xx seconds (default: 3600 = 1 hour)
-------------------	-----------	--

Additional settings for type 1 = serial cable.

LineDeviceID	REG_DWORD	Line device ID of null-modem (default: 0). The line device ID is used to select one of several configured modems. If just one modem is configured it is always 0.
---------------------	-----------	---

Additional settings for type 2 = modem.

CountryCode	REG_DWORD	Country code to reach status agent modem (default: 0)
PhoneNumber	REG_SZ	Telephone number (incl. area code) to reach status agent modem
LineDeviceID	REG_DWORD	Line device ID of modem (default: 0). The line device ID is used to select one of several configured modems. If just one modem is configured it is always 0.

Additional settings for type 3 = LAN using TCP/IP.

Path	REG_SZ	Network path consisting of status agent adapter IP address, port number (fixed), IP address of own LAN adapter, such as: "193.81.166.33:64257/143.81.166.100"
-------------	--------	---

The following port numbers should be used.

64257 .. for connection 1 primary master – status agent
64258 .. for connection 2 primary master – status agent
64259 .. for connection 1 secondary master – status agent
64260 .. for connection 2 secondary master – status agent

Additional settings for type 4 = LAN via named pipes.

Path	REG_SZ	Workstation name of PC running status agent process
-------------	--------	---

The **StatusAgent\Connection1\Type** registry key, if present, indicates that a Status Agent is expected by TCOSS. If it is not set, the hardware status box with V.24 connection is used instead.

Status Agent Configuration

The settings of the status agent process are stored in the registry under the key "HKEY_LOCAL_MACHINE\SOFTWARE\TOPCALL\TCSTATUS".

CommandLine	REG_SZ	Command line used by TCSRVR to start the status agent process
LogonType	REG_SZ	For TCSRVR
UserId	REG_SZ	User account for TCSTATUS process
Domain	REG_SZ	NT domain of NT user set in UserId

Password	REG_SZ	Password of NT user set in UserId (encrypted)
-----------------	--------	---

The details of the up to 4 connections served by the status agent are set under the subkeys:

- TCSTATUS\PrimaryMaster\Connection1
- TCSTATUS\PrimaryMaster\Connection2
- TCSTATUS\SecondaryMaster\Connection1
- TCSTATUS\SecondaryMaster\Connection2

A single modem used for connections from both primary and secondary master is configured only once in either section.

Type	REG_DWORD	Type of connection <ul style="list-style-type: none"> • 0 = not active • 1 = serial cable (hardware status box TS85, no longer supported) • 2 = modem (hardware status box TS85, no longer supported) • 3 = LAN using TCP/IP • 4 = LAN using named pipes (must not be used)
-------------	-----------	--

Additional settings for type 1 = serial cable.

LineDeviceID	REG_DWORD	Line device ID of null-modem (default: 0). The line device ID is used to select one of several configured modems. If just one modem is configured, it is always 0.
---------------------	-----------	--

Additional settings for type 2 = modem.

LineDeviceID	REG_DWORD	Line device ID of modem (default: 0). The line device ID is used to select one of several configured modems. If just one modem is configured it is always 0.
---------------------	-----------	--

Additional settings for type 3 = LAN using TCP/IP.

Path	REG_SZ	Network path consisting of TCOSS server adapter IP address (optional), IP address of own LAN adapter, port number (fixed), such as: "193.81.166.100/143.81.166.33:64257"
-------------	--------	--

The following port numbers should be used.

64257 .. for connection 1 primary master – status agent
64258 .. for connection 2 primary master – status agent
64259 .. for connection 1 secondary master – status agent
64260 .. for connection 2 secondary master – status agent

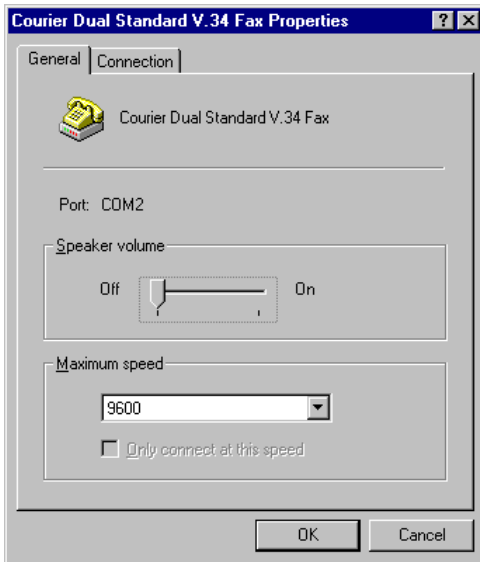
FastClose	REG_DWORD	Behavior of TCP/IP connection after requests from TCOSS <ul style="list-style-type: none"> • 0 = Connection is kept open so that further requests may be handled with the same TCP/IP session (even this is currently not done by TCOSS). This is the default. • 1 = Close the TCPIP connection soon as possible after access by TCOSS. This value may be used in agreement with technical support, if the connection is not correctly closed by the calling system. (See bug 1140703)
------------------	-----------	--

The disk status itself is stored under the "HKEY_LOCAL_MACHINE\SOFTWARE\TOPCALL\TCSTATUS" subkey.

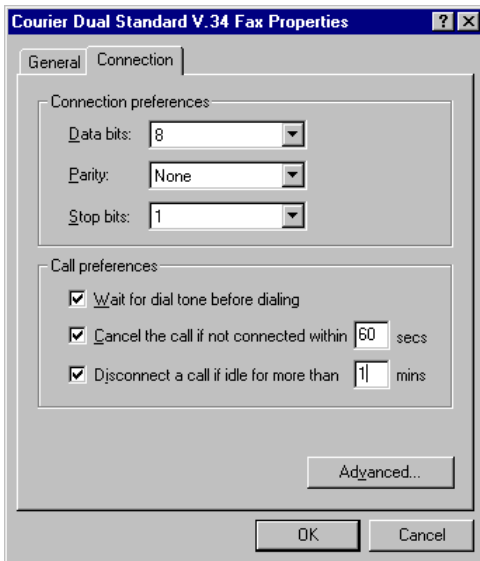
PrimaryMaster\DiskState	REG_DWORD	Disk state flags of primary master
SecondaryMaster\DiskState	REG_DWORD	Disk state flags of secondary master

Windows Setup

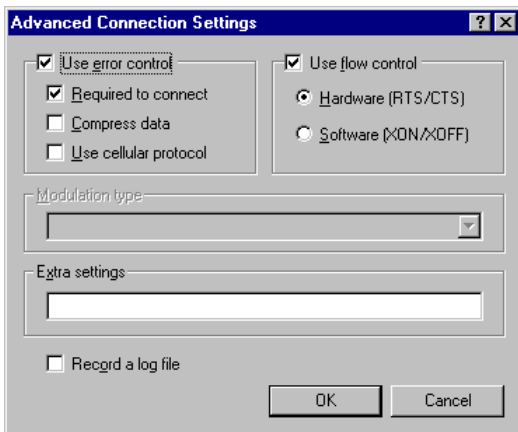
If modem or serial (null-modem) connections are used, a modem must be installed on the appropriate TCOSS master and status agent using the "Modems" functions for Windows Control Panel. For a serial connection, select "Dial-Up Networking Serial Cable between 2 PCs"; otherwise, select the type of the modem used. The modem properties should be set like this.



Set the maximum speed to not more than 9600 baud. It may be set lower if TCOSS operator warnings such as "Status Agent Access Timeout on Connection2 from Secondary Master via Modem" appear without any obvious reason such as a disconnected cable. Communication errors are less likely with a lower baud rate; the minimum speed necessary for the status agent communication is 1200 baud.



The "Wait for dial tone before dialing" has to be disabled if the modem is connected to a PBX.



After adding or removing modems in the Control Panel, always restart Windows.

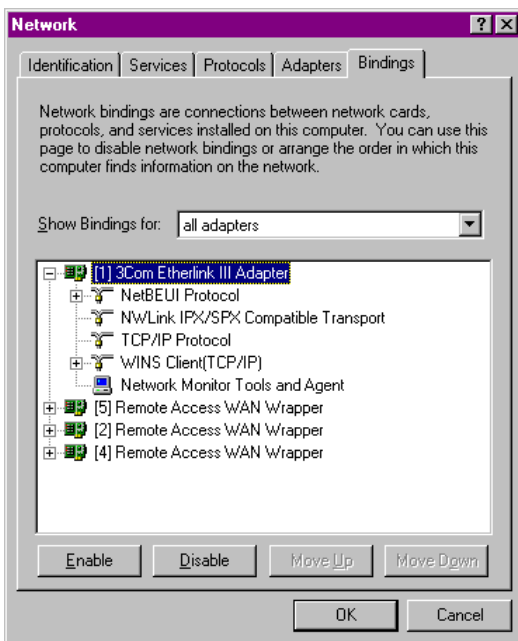
Chapter 3

Hints

This section provides various hints for setting up a tandem server.

Disabling NetBIOS for an Adapter

If NetBIOS is not wanted for a certain network adapter, it can be disabled using the bindings view within the network settings dialog box.



Select "all adapters" to show the bindings for the adapters. Select and disable the "WINS Client" and if available, the "NetBEUI Protocol."

Important Windows networking may not work properly if you disable these bindings on the first adapter installed. Either change the connections to the adapter, or reinstall the adapter to ensure the adapter used to disable bindings is not the first one.

TCP/IP Path Syntax

For the Tandem Server, installing TCOSS and the status agent requires a TCP/IP path to be configured. TCOSS may use a TCP/IP path for the data link connection between both master servers and for the connections to the status agent. In the latter case, you need not have to deal with the actual syntax of the path. The setup procedures ask for the parts of the path such as the IP address of the local network adapter to use, or the target IP address. After entering this information, the full path is generated by concatenating strings and adding more information.

For the data link connection between the master servers, the setup procedures of the current KCS don't do this for you. The full path has to be entered.

To specify the correct path is especially important in multi-homed systems such as those with multiple network adapters.

Within the registry, the significant values for operation always contain the full TCP/IP path. For example:

The **/TCP**: switch of the command line for TCOSS:

```
HKEY_LOCAL_MACHINE\Software\TOPCALL\TCOSS
CommandLine = "TCOSS.EXE /M:M22X_1 /TCP:193.81.166.121/193.81.166.122"
```

The connection path to the status agent:

```
HKEY_LOCAL_MACHINE\Software\TOPCALL\TCOSS\StatusAgent\Connection1
Path = "193.81.166.123:64257/193.81.166.122"
```

In multi-homed systems, the syntax of the TCP/IP path allows selection of a dedicated network adapter to use to establish connections. This is very important, Windows does not iterate through the adapters to search for the network with the appropriate server. The adapter being used by default depends on the order of the adapter bindings.

In addition, it is possible to specify the TCP/IP port to use to establish the connection. In contrast to the server IP address, the port number selects a specific "channel" on that server.

Full Syntax:

```
[<Target IP>][:<Target Port>][/[<Local IP>][:<Local Port>]]
```

The IP addresses may be specified in dotted name format such as *m22x.kofax.co.at*; even *m22x* is valid as long as the system is able to resolve the names. The IP address as a dotted number should always be preferred, because connecting is faster and there is no name resolution that may fail.

The port number can be a service name registered with the *Services* file in *\System32\drivers\etc*. A decimal number should be preferred.

For the data link connection between the master servers, the TCP/IP ports must not be specified. The default value (64256) is reserved for the data link and is saved for this specific use. By default, the control connection between a master's TCOSS and the other master's TCSRVR use the same path specifier but a different default port.

The syntax to be used with Setup:

```
<Target IP>[/<Local IP>]
```

On a system with a dedicated LAN as a data link between both master servers, <Local IP> is the IP address of the network adapter for the dedicated LAN. <Target IP> is the other master server's dedicated LAN IP address. If the server has only one adapter, the local IP specifier can be left.

For the connections to the status agent, the ports have to be specified for the addresses pointing to the server (status agent). The client address (TCOSS) should not have a port.

Additionally, the server side (status agent) need not have a client address (target IP). If specified, it is ignored.

Syntax generated by Setup for TCOSS (Client):

```
<Target IP>:<Port>[/<Local IP>]
```

Syntax generated by Setup for the status agent (Server):

```
/[<Local IP>]:<Port>
```

Note Items in Square Brackets ('[' and ']') are optional.

Null-Modem Cable Layout

The serial cable, which is used to directly connect a TCOSS master to the Status Agent (without a modem), has female 25-pin V.24 connectors on both sides and the following pin connections (it is symmetrical).

Connector A		Connector B	
Pin 1	Protective Ground	Pin 1	Protective Ground
Pin 7	Signal Ground	Pin 7	Signal Ground
Pin 2	Transmitted Data	Pin 3	Received Data
Pin 3	Received Data	Pin 2	Transmitted Data
Pin 5	Clear to Send	Pin 20	Data Terminal Ready
Pin 20	Data Terminal Ready	Pin 5	Clear to Send
Pin 4	Request to Send	Pin 6 + Pin 8	Data Set Ready Received Line Signal Detector
Pin 6 + Pin 8	Data Set Ready Received Line Signal Detector	Pin 4	Request to Send

Chapter 4

Prerequisites

This section describes prerequisites for setting the tandem server.

Status Agent

General Kofax Communication Server prerequisites apply.

- TCMON 7.10.00 or higher
- KCS Tandem Server with TCOSS 7.22.00 or higher

For certain configurations:

- Windows compatible modem (min. 1200Bd)
- Serial Null Modem Cable
- Adapter with additional COM port
- Second network connection (Bandwidth not critical)

Tandem Server

General requirements:

- TCOSS 7.22.00 or higher
- TCMON 7.10.00 or higher
- Data Link LAN (Bandwidth - see below)

For certain configurations:

- Windows compatible modem (min. 1200Bd)
- Second network connection

Network Quality

The overall system throughput considerably depends on the quality of the network connection used for the data link.

The quality of the network connection is defined by the usable bandwidth and packet roundtrip times.

The usable bandwidth is determined by the type of LAN used. An Ethernet connection, for instance, provides a 10Mbit/s or 100Mbit/s connection that can (theoretically) be fully utilized if there are no other

devices connected to this sub-network. The usable bandwidth determines the theoretical minimum time a certain amount of data takes to be transmitted over the network.

In reality, the time a data packet takes to be transmitted over the network increases due to additional effects. Such effects can be driver or hardware latency times, delays caused by collisions on the network (especially for Ethernet) and the propagation delays of the electrical signals on the physical line.

For Tandem Servers, the maximum time data may take to travel over the network is specified as maximum roundtrip time. The roundtrip time is the sum of all times and network delays in both directions. This approximates the overhead for one transaction (Request -> Response) between the master servers.

By now, there are two ways to determine the network roundtrip time. The easiest method is to "ping" the remote server. The TCP/IP Ping utility sends a small packet to the remote system and measures the time it takes to receive a reply. Unfortunately, this gives only a rough estimation of the network latencies with only about 10 ms resolution in the best case.

A more accurate value is given by the primary server while starting up the secondary server. When the primary server establishes the connection to the secondary server, it takes a snapshot of the network speed and writes the value into the trace file (*waitforslave: X ms link roundtrip time!*).

Certain conditions regarding network quality have to be met to guarantee high message throughput for the tandem system.

Entry Level Systems (up to 6 FAX Lines, max. 5 client/server channels, max. 1 Link):

- At least 1 Mbit network bandwidth
- Less than 50 ms packet roundtrip time

High End Systems (60 FAX lines and above)

- At least 5 Mbit network bandwidth
- Less than 10 ms packet roundtrip time

The values given above are minimum requirements for proper operation of the FAX channels.

On high system loads, interactive clients such as TCfW may suffer from reduced responsiveness.

Performance Degradation During Fault Recovery

During system startup, the primary master reads large amounts of data from the hard disk to initialize its internal data structures and to boot the channels. During normal operation, this data is read from the local disk only.

If the local disk of the primary master is not up to date because the secondary master ran standalone, the primary master has to boot from the remote (the secondary master) hard disk. In this case, all data read to initialize the system has to be transmitted over the network. In addition, the primary master's disk is resynchronized with the remote hard disk, which greatly increases the amount of data to be transferred over the network.

These network loads may multiply the total startup time of the system by about 10 to 20. Especially if many data blocks differ between both hard disks and with networks which meet the minimum requirements only.

The time the system initializes its internal directory structure (*TCOS init DIR*) may increase from around one minute to more than one hour (additionally depends on the directory size). In contrast, the time to load and start the channels rather slightly increases from up to 10 minutes usually, to around 15 minutes.

Note It is not possible to give exact figures for system startup times because these values depend on many different factors:

- Network roundtrip time
- Network bandwidth
- Configured directory size
- Amount of resynchronization data
- Number, type and location of channels

In normal operation (system booted, disks mirrored) the primary master performs optimized read accesses to the local hard disk. If the primary master's hard disk is not up to date, this read optimization is not in effect and all disk accesses have to be done via the network to the remote hard disk. This reduces the system performance and the specified message throughput cannot be achieved until the hard disk resynchronization is finished.

Performance degradation during fault recovery depends considerably on the network speed.

Chapter 5

Tandem Operation in Error Cases

In recent Kofax Communication Server versions, the behavior of tandem operation is improved. The goal of the improvements is to avoid that the tandem system falls into the "desynchronized" state where one of the two disks has to be cleared to go back to normal operation.

The improvements can be deactivated using a new registry value, which must be set identically on both the primary and secondary master:

```
HKEY_LOCAL_MACHINE/SOFTWARE/Topcall/TCOSS/RunWithoutStatusAgent (REG_DWORD)
```

0 ... never run without proper quorum (default)

1 ... primary/secondary master can run stand-alone without status agent

If RunWithoutStatusAgent is set to 0, the system should never go into the "desynchronized" state, at the expense of not running at all in certain error situations. This is the default and the recommended setting.

If RunWithoutStatusAgent is set to 1, the primary / secondary master is allowed to run standalone if both the other server and the status agent can't be reached. This is the same behavior as in previous releases. It may produce a "desynchronized" state in case of network partitioning. Operators can set this value to 1 on the surviving server if they know that the other server of the tandem system has gone out of operation and the status agent is also not able to run or can't be reached because of network problems.

The Kofax Communication Server setup creates the RunWithoutStatusAgent registry value with its default value of 0 if it does not exist already.

Note The WConfig function "Install configuration locally," if used on both primary and secondary master, may still cause a "desynchronized" state of a tandem system. Make sure the tandem system is in the healthy state before running WConfig and clear the secondary master disk afterwards if a "desynchronized" state is indicated.

Running Tandem System Loses Secondary Master

If the tandem system is running in the healthy state and the connection to the secondary master breaks down, or the secondary master stops working, the status agent has to be updated with the state that the primary master is running standalone (and the secondary master's disk is out-of-date).

In this error situation, if the status agent cannot be reached and updated (for example, the network connection is down), there are two possible ways to continue:

- Improved Behavior
- Old Behavior

Improved Behavior

With the improved behavior, selected by `RunWithoutStatusAgent = 0`, the primary master stops with the error message "Model/22x sync stop (no write quorum)" and then restarts. This is correct because a single node (the primary master) does not have the proper write quorum (2 of 3 nodes) to continue.

Old Behavior

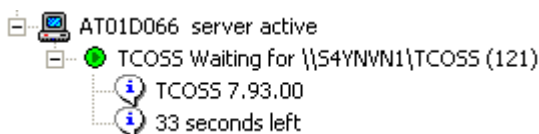
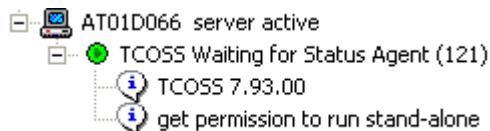
In the old behavior, selected by `RunWithoutStatusAgent = 1`, the primary master continues and creates the warning message "single disk operation on disk 1 started without status agent update." Continuing here without a write quorum may lead to a "desynchronized" state later on.

Primary Master Starts Without Secondary Master

If the primary master starts up and cannot reach the secondary master, and if its disk is still in state "mirrored," which means it has been running in tandem operation before the shutdown, the status agent has to be updated.

Improved Behavior

With the improved behavior, selected by `RunWithoutStatusAgent = 0`, the status agent is contacted before TCOSS continues to boot. Kofax Communication Server Monitor displays the status lines "Waiting for Status Agent" and "Waiting for \\SecondaryName\TCOSS" in an alternating manner. The primary master waits until either the status agent updates properly, or the secondary master reconnects. When waiting for the status agent, the second information line displayed by the KCS Monitor reads "get permission to run stand-alone." When trying to boot the secondary master, the line "nn seconds left" is displayed.



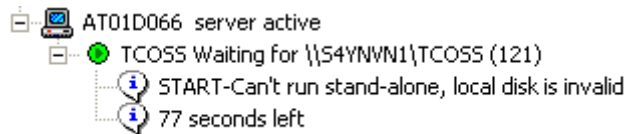
If the status agent does not allow the primary master to run stand-alone, because the secondary master has been running stand-alone before, the primary master continues to wait for the secondary master. The primary master displays the status line "Waiting for \\SecondaryName\TCOSS," but does not contact the status agent again.

During this possible indefinite wait, the `RunWithoutStatusAgent` registry value is read at regular intervals so that an operator can modify this value and set it to 1, allowing the primary master to continue. The registry reload interval depends on the status agent access timeout (default 120 seconds) and the time

of a secondary master reboot attempt (90 seconds). Therefore, the total waiting time to see any effect is about 3.5 minutes after changing the registry value.

A minor drawback of the improved behavior is that the status agent is updated before the TCOSS file system restarts. It can happen that the primary master is actually unable to start, such as when its file structure is corrupted. Then the status agent update would prevent the secondary master from running stand-alone. But this case is considered very unlikely.

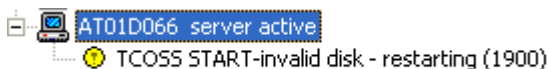
In case the primary master's disk is invalid (in the process of being updated from the secondary master), the primary master does not contact the status agent but tries to start the secondary master.



Old Behavior

In the old behavior, selected by `RunWithoutStatusAgent = 1`, the primary master continues in the boot process until the first disk write occurs. This usually happens when the system startup is complete and the system message "TCOSS 7.xx.xx (using module TCOSS.EXE 7.xx.xx) started" is created. Then the primary master tries to reach and update the status agent. If it fails, the primary master continues and creates the warning message "single disk operation on disk 1 started without status agent update." This behavior is the same as in the first error case "Running tandem system loses secondary master" and may lead to a "desynchronized" state later.

In case the primary master's disk is invalid (in the process of being updated from the secondary master), the primary master stops with the error message "invalid disk" and then TCSR service restarts it.

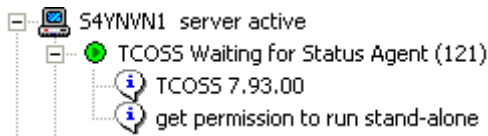


Secondary Master Starts Without Primary Master

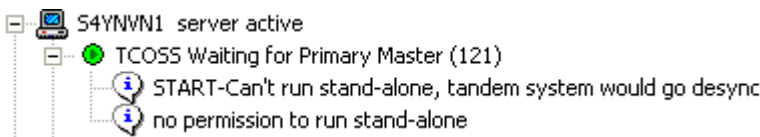
If the secondary master starts up and cannot reach the primary master, and if its disk is still in "mirrored" state (it has been running in tandem operation before the shutdown), the status agent has to be updated.

Improved Behavior

With the improved behavior, selected by `RunWithoutStatusAgent = 0`, the status agent is contacted before TCOSS continues to boot. KCS Monitor displays the status line "Waiting for Status Agent, " with the information line "get permission to run stand-alone." The secondary master waits here until either the status agent updates properly, or the process is shut down by the primary master.



If the status agent does not allow the secondary master to run stand-alone, because the secondary master's disk is out-of-date, the secondary master continues to wait for the primary master, without contacting the status agent again, showing this state in KCS Monitor:



An event log entry with the event ID 16005 and the error message "Can't run stand-alone, tandem system would go desync" is added.

During this possible indefinite wait, the RunWithoutStatusAgent registry value is read at regular intervals so that an operator can modify this value and set it to 1. This allows the secondary master to run standalone without a status agent update. The registry reload interval depends on the status agent access timeout (default 120 seconds). Therefore, the total waiting time to see any effect is about 2 minutes after changing the registry value.

Old Behavior

In the old behavior, selected by RunWithoutStatusAgent = 1, the secondary master remains in the boot process until the first disk write occurs. This usually happens when the system startup is complete and the system message "TCOSS 7.xx.xx (using module TCOSS.EXE 7.xx.xx) started" is created. Then the secondary master tries to reach and update the status agent. If it fails, the secondary master continues and creates the warning message "single disk operation on disk 1 started without status agent update." This behavior is the same as in the first error case "Running tandem system loses secondary master "and may lead to a "desynchronized" state later.

If the status agent does not allow the secondary master to run stand-alone because its disk is out-of-date, the secondary master stops with the error message "Model/22x sync stop" and then the TCSRVS service restarts it. After the restart, the secondary master runs again into the "Model/22x sync stop" and waits as long as the status agent can be reached. Once the status agent cannot be reached, the secondary master continues and runs stand-alone, resulting in a "desynchronized" state.

Install Configuration Locally to Primary/Secondary Master

The WConfig function "Install configuration locally" starts TCOSS in a single server mode. The other TCOSS master and the status agent are not running in this scenario. Because TCOSS is running in single server mode, there are no checks on whether the disk update is allowed or may cause a "desynchronized" state.

Make sure the tandem system is in the healthy state before running WConfig. Clear the secondary master disk afterwards if a "desynchronized" state shows up.

With previous TCROSS releases, the event log warning "single disk operation on disk 1 started ok" was written on a local installation. This message is not correct because the status agent is not checked in this scenario. Therefore, the event log warning is changed to "single disk operation started in single server mode without status agent check."