Chapter 3
Hot Standby Scan Time

- Two Factors that Influence Hot Standby Scan Time
- The Effects of State Table Transfer on Scan Time

Two Factors that Influence Hot Standby Scan Time

A Hot Standby capability necessarily adds more scan time to a comparable standalone 984 controller. The way you program your HSBY function block and I/O ladder logic can help to minimize this increased scan time.

Minimizing the Scan Time Increase

The amount of scan time increase varies according to two things:

- The size of the state RAM table
- The length of the nontransfer area in the controller's state RAM, as defined in the HSBY function block

While programming your Hot Standby System, you can help reduce the increase in scan time by not utilizing unnecessary area in the state table and by defining as much nontransfer area as possible.

Contents of the State RAM Table

The state RAM table contains all current I/O references (0*x* coils, 1*x* discrete inputs, 3*x* register inputs, and 4*x* holding registers), history bits, and DISABLE tables. You can minimize the time it takes to transfer state data by defining the state table with the smallest possible amount of state RAM area. Do not use all available state RAM unless your particular application requires it.

If you have16-bit CPUs in your Hot Standby system (a pair of 984A, 984X, 984-680, or -685 Programmable Controllers), the largest possible state RAM area is 3K words. If you have 24-bit CPUs in your Hot Standby System (a pair of 984B, 984-780, or -785 Programmable Controllers), the largest possible state RAM area is 12.8K words.

Nontransfer Area

You can minimize the time it takes to transfer the state table by defining the largest possible nontransfer area—and therby reducing the amount of state RAM data that does transfer.

If you have 16-bit CPUs in your Hot Standby system (a pair of 984A, 984X, 984-680, or -685 Programmable Controllers), the largest possible nontransfer area you can define is 255 words. If you have 24-bit CPUs in your Hot Standby system (a pair of 984B, 984-780, or -785 Programmable Controllers), the largest possible nontransfer area you can define is 8000 words.

Caution **Make sure the nontransfer area you define contains no critical data. No data in the nontransfer area is transferred to the standby controller, and all data in the nontransfer area is lost at switchover.**

The Effects of State Table Transfer on Scan Time

A Hot Standby System transfers state table data from the primary controller to the standby controller while the primary controller scans and solves I/O ladder logic. There are two steps in this transfer process—CPU-to-S911 transfer and S911-to-S911 transfer.

CPU-to-S911 State Table Transfer

As soon as the primary controller executes its HSBY function block, it starts transferring the current state table from its CPU to its S911 Hot Standby module. Ladder logic scanning and I/O servicing halt while this data transfer takes place.

CPU-to-S911 state transfer takes 1.3 ms/K words that transfer—add another 3 ms for overhead. As soon as the CPU-to-S911 transfer finishes, the primary controller resumes scanning ladder logic and servicing I/O.

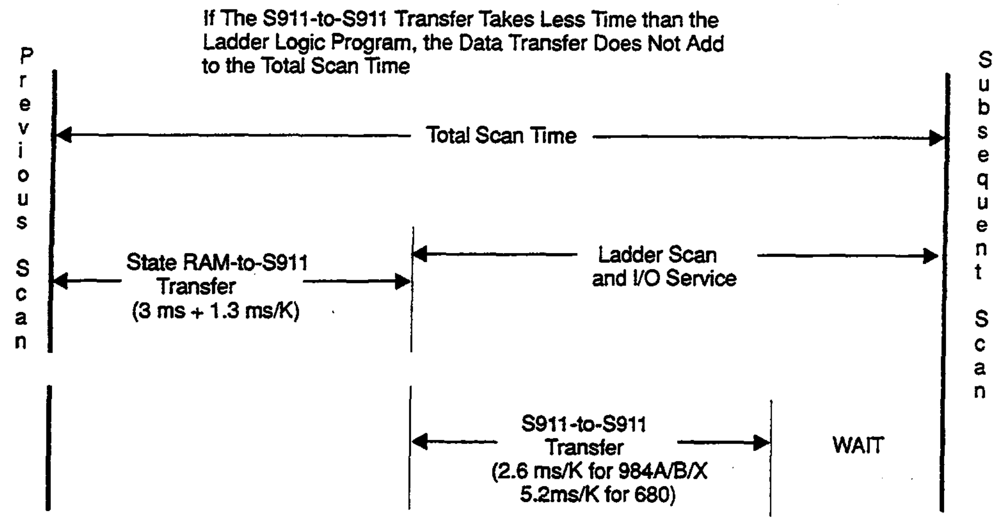
S911-to-S911 State Table Transfer

As the ladder logic scan resumes, the primary controller starts to simultaneously transfer the state table from its S911 to the S911 in the standby controller through the W911 cable link.

If your Hot Standby System uses chassis mount (984A, 984B, or 984X) Programmable Controllers, the S911-to-S911 transfer time is 2.6 ms/K words. If your Hot Standby system uses slot mount (984-680, -685, -780, or -785) Programmable Controllers, the S911-to-S911 data transfer takes 5.2 ms/K words.

When the I/O ladder logic program being scanned by the primary controller is longer than the S911-to-S911 data transfer, the transfer does *not* increase total scan time. However, if your logic ladder program is relatively short, the ladder scan will finish before the S911-to-S911 data transfer. In this case, S911-to-S911 data transfer increases total scan time.

Figure 7 shows the possible effects of state transfer time on total system scan time.



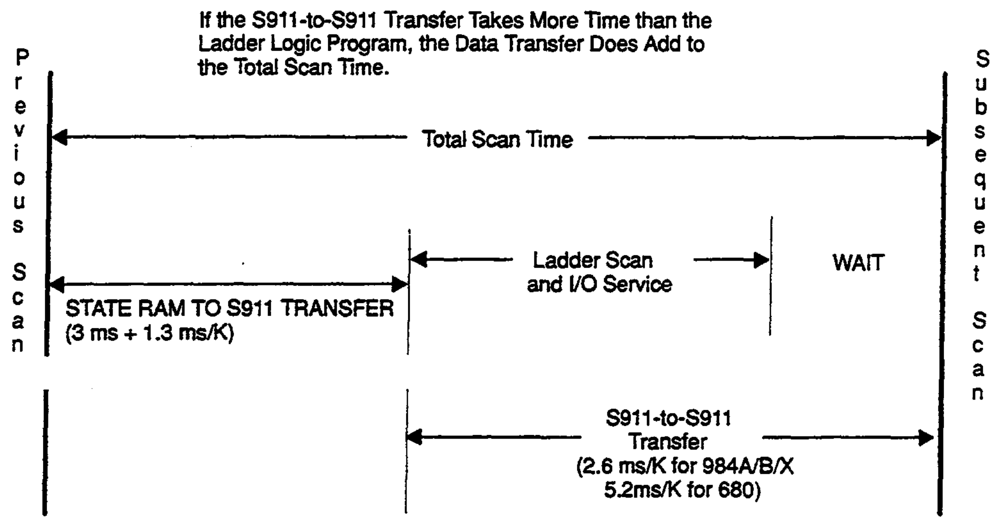


Figure 7 Hot Standby System Scan Times

Chapter 4 Optional System Control Techniques

- Using Software for Optional System Control
- Option Processors in a 984 Hot Standby System

Using Software for Optional System Control

You can monitor your Hot Standby System through bits in the HSBY status register (register 3 in the nontransfer area table specified in the middle node of the HSBY function block). You can control various Hot Standby functions with bits in the HSBY command register.

Logic for Optional Monitoring Indicators

You can design ladder logic that monitors any or all of the six bits in the HSBY status register. Status data can then be read by panel software, Modbus, or I/O.

Logic for Remote Control of Keyswitch Functions

You can also design ladder logic to monitor inputs from Modbus or I/O, and thereby control any or all of the seven bits in the HSBY command register. You can use these bits to remotely control functions usually performed by the keyswitches on the S911 Hot Standby modules. For example, by remotely manipulating command register bits 14, 15, and 16, you can take the current primary controller OFFLINE and thereby force switchover.

The Value of Optional System Control

Optional system control is very useful in situations where the Hot Standby controllers are positioned in hard-to-get-to places. Optional system control can also be used to automatically recognize a fault and force a switchover under conditions not handled by a standard hot standby configuration—e.g., faults in option processors such as a C986/C996 Coprocessor or an S975 Modbus II.

An Optional System Control Panel Example

An example of the ladder logic for an optional system control panel is shown on the following pages. The logic is based on eight assumptions:

- RUN or OFFLINE modes are specified via keyswitches on an optional control panel
- RUN/OFFLINE control capabilities are transferred to the optional control panel via bit 16 in the command register—bit 16 is connected to input 10413
- RUN/OFFLINE control of Controller A (command register bit 15) is through input 10414
- RUN/OFFLINE control of Controller B (command register bit 14) is through input 10415
- You want offsets of 128 between both the Modbus addresses in ports 2 and 3 of the primary and standby controllers; you do not want any offset between the Modbus port 1 addresses in the primary and standby controllers
- 41009 is the command register reference

- 42001 is the start of the nontransfer area in state RAM—i.e., it is specified in the middle node and is reserved as the first of two reverse transfer registers
- A FAULT lamp (output 00207) on the optional control panel will turn ON if the stand-by controller goes OFFLINE.

Figure 8 shows the HSBY block set-up for this example:

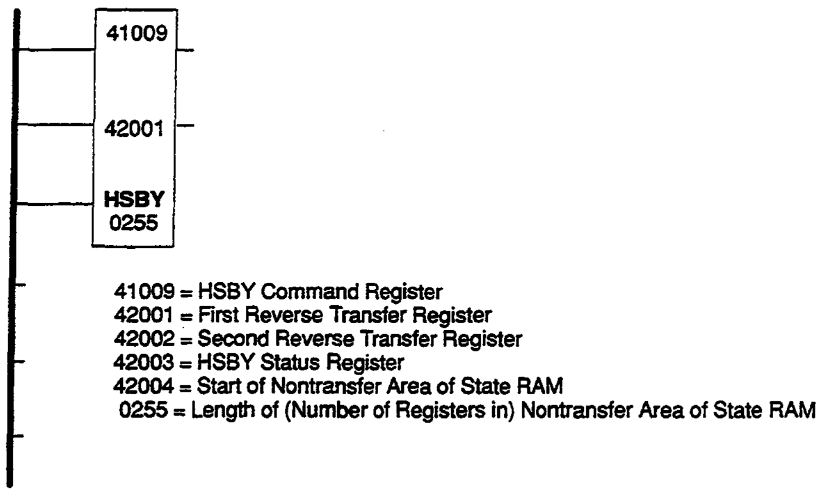


Figure 8 HSBY Block for an Optional Control Panel

Since you do not want to leave command register bits 16, 15, and 14 at 0, you must control them through ladder logic, as shown in Figure 9. You can control bits 6 and 7 through ladder logic or set them through the 984 programmer tape (or disk file).

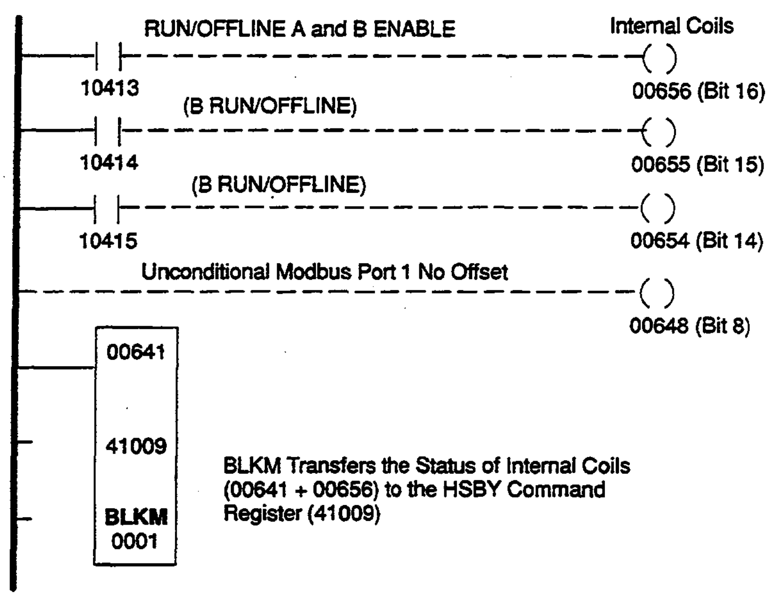


Figure 9 Example of Input Logic for an Optional Control Panel

Option Processors in a 984 Hot Standby System

The *soft control* capability of the 984 Hot Standby System allows the ladder logic to automatically override the S911 keyswitches and force a transfer of control to the active standby unit. This operation, although not common in typical applications, is necessary to support redundancy while using other 984 option processors.

Other 984 Option Processors

Other 984 option processors include the S975 Modbus II, the S985 Modbus Plus Interfaces, and the C986/C996 Coprocessors.

Forcing a Soft Control Switchover

A 984 Hot Standby System will not automatically switch over in the event of an option processor failure.

To force a controller OFFLINE in the event of a fault in one of its option processors, the logic shown in Figure 10 should exist in the controller. We recommend that identical logic exist in both controllers so that fault detection can be supported in both.

If the primary controller is forced OFFLINE, the standby will take control of the system; if the standby is forced OFFLINE, the primary will continue to operate as a standalone controller.

Make sure that bits 1 ... 13 are preset in 40200 (the HSBY command register) before running the system.

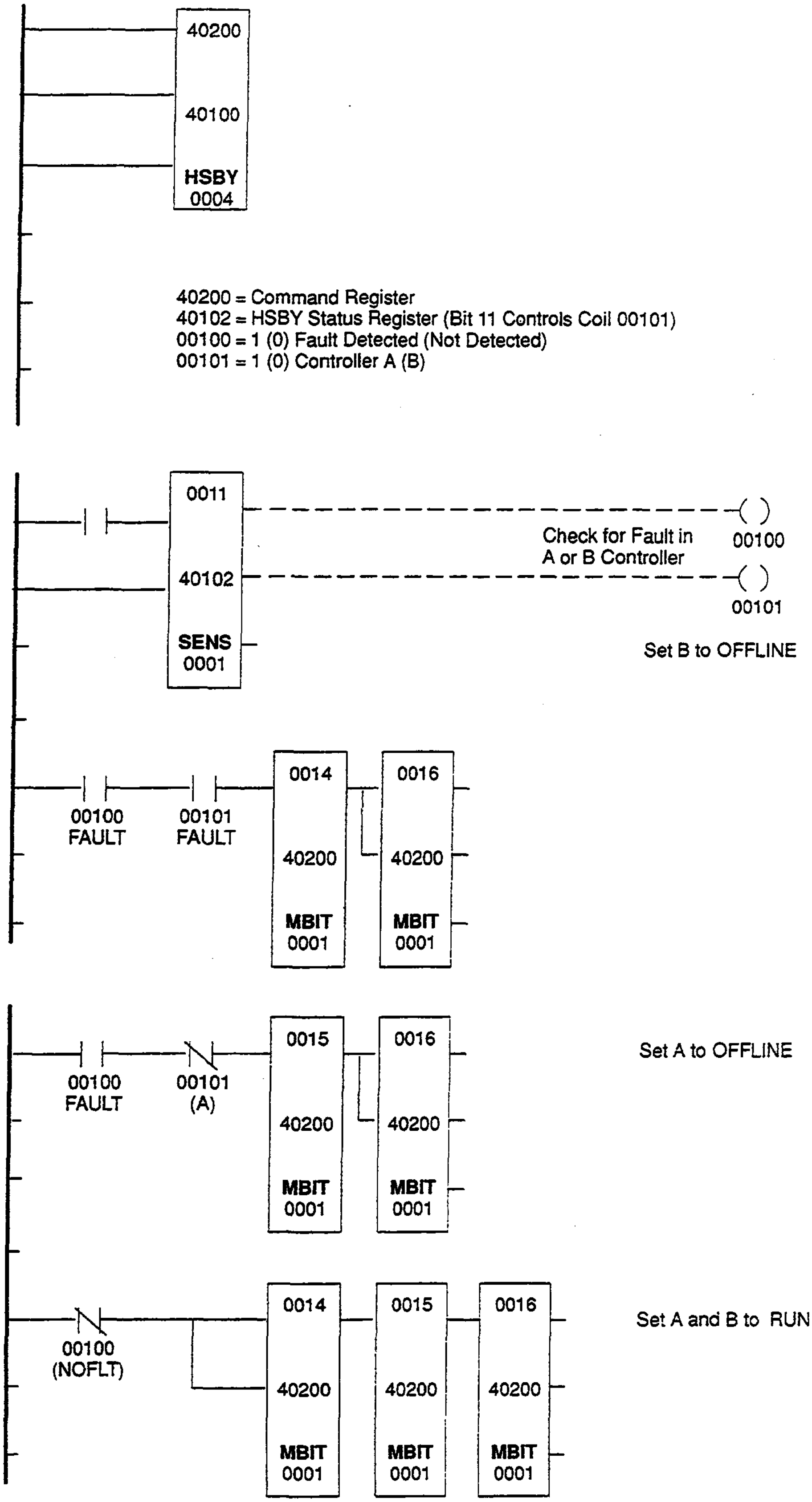


Figure 10 Switchover Logic for an Option Processor