S509 POS MONITOR CARD

Release 3.01

Operations Manual

August 9, 1995

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1. Introduction

The S509 Card is a high performance multiprotocol ISA bus adapter designed for the POS monitoring environment

The card has 2 high impedance read-only POS ports capable of reading traffic on either two IBM 4680 loops or two NCR 2126/2127 lines or one NCR 1255 line.

There are 2 RS485 asynchronous ports that are capable of sending and receiving data.

The card has an on-board co-processor and uses an 8K dual-port memory window to communicate with the host PC. The window can be set at one of 28 high memory locations. The card operates without interrupts or DMA to the PC.

The S509 card is capable of simultaneously reading data without loss from two IBM 4680 loops operating at 38.4 Kbps, or one NCR 2126 loop operating at 48 Kbps, or one NCR 1255 line operating at 1.25 Mbps, while sending and receiving simultaneously on two asynchronous ports operating at up to 19.2 Kbps. The card can also monitor the NCR 7000 system and the Fujitsu/ICL system

All control of the card is through a mailbox structure in the shared memory window of the card and PC. There is also an optional interrupt.

2. Hardware

General

The Sangoma S509 adapter is compatible with an ISA bus and comprises of a Z80182 Intelligent Peripheral Controller, a specialized POS interface, 128K of RAM and memory and address decoding logic. The card acts as a passive device on the PC bus, operating without interrupts or DMA and is accessed by the PC through a shared memory window.

The S509 adapter has the following features:

- The card is largely software configured. Only the I/O address is set by jumpers on the IS card.

- The board has been designed to make it usable in all PC class machines, from the slowes 8088 computers to the latest Pentium models.

- The board has been designed to permit operation in an 8K paging window mode to conserve high memory space.

- The board does not occupy PC memory space until it is configured.

Multiple boards will operate in one machine.

Hardware Configuration

I/O port address:

This is set by Jumpers JP1, JP2 and JP3 as shown below. Valid addresses are 250 (Default), 270, 280, 300, 350, 360, 380 and 390 hex.

I/O Address Jumpers

Address	JP1-1	JP1-2	JP1-3
0x250	IN	IN	IN
0x270	IN	IN	OUT
0x280	IN	OUT	IN
0x300	IN	OUT	OUT
0x350	OUT	IN	IN
0x360	OUT	IN	OUT
0x380	OUT	OUT	IN
0x390	OUT	OUT	OUT

Memory sharing:

This is set up in software.

Cabling

The DB25 Female connector on the S509 card supports both POS loop interfaces, plus both RS485 ports. The connections are as follows:

S509 DB25 pins:

```
20 ——————————————  RXA+    POS
 9 ——————————————  RXA-    POS
23 ——————————————  RXB+    POS
12 ——————————————  RXB-    POS
 6 ——————————————  TXC+    RS485
19 ——————————————  TXC-    RS485
16 ——————————————  RXC+    RS485
 3 ——————————————  RXC-    RS485
 5 ——————————————  TXD+    RS485
18 ——————————————  TXD-    RS485
17 ——————————————  RXD+    RS485
 4 ——————————————  RXD-    RS485
```

3.   Software Modules

General

Software support for the IBM 4680, NCR 1255 or NCR DLC consists of the following modules:

S509LOAD.EXE configures S509 Adapter, runs through a self test, loads the microcode onto adapter and starts the program

POSxxxx.509 is the run-time microcode POS module loaded by **S509LOAD.EXE**.

Three versions of microcode are supplied:
POS4680.509 - support for IBM 4680 POS system
POS2126.509 - support for NCR 2126/2127 POS systems
POS1255.509 - support for NCR 1255 syste

Resident code loader: S509LOAD.EXE

S509LOAD.EXE is a DOS application and has the following command line syntax:

S509LOAD -i=*io_port* -m=*memory filenam*

where:

io_port   is a hexadecimal number which defines the I/O port address as set by the jumpers on the card. Valid values are 250, 270, 280, 300, 350, 360, 380 and 390. If not set, default is **250**.

memory   is a hexadecimal number which defines the segment address of the 8 shared memory window which the PC sees as being occupied by the S509 card. Valid values are x000, x200, x400, x800, xA00, xC00, xE00, where x=A,C,D or E. If not set, default i   **C800.**

Note, that only four digits are required to specify segment address.

filenam   is the name of the file containing the microcode to be loaded onto S509 card to support particular POS implementation, e.g. POS4680.509. Extension .MIC is assumed by default. If not specified, default is POS.MIC

All command line argument are optional and case insensitive. If all or any of these arguments are omitted, default values are assumed.

Example:

S509LOAD -i=250 -m=E000 \POS\POS4680.509

S509LOAD sets up the card located at I/O base address 250 for memory window starting a segment E000, performs a system test, and loads and configures the adapter for monitoring a 4680 system.

When running, S509LOAD displays its logo and the configuration options used for setting up the card. If card is successfully loaded then microcode identification string is displayed, showing microcode version and release numbers.

If the S509 card does not load successfully, a beep will sound, an error message will be displayed on the screen and a non-zero exit code will be returned to a parent DOS process.

Note: The PC memory address space chosen for S509 shared memory window must no be used by other devices or memory management software such as EMM386, QEMM, etc. For instance, if you are using EMM386 memory manager and would like to set up S509 memory window at segment E000 (hex), then command line argument **X=E000-E1FF** must be added to EMM386 command line, usually found in CONFIG.SYS file, to exclude the 8K bytes occupied by the S509 card from the memory managed by EMM386 (see your memory management software manua for more information).

Resident code: POSxxxx.509

This is the POS support code which is loaded onto the card to run the communications handling.
Currently supplied are:

POS4680.509 - support for IBM 4680 POS system
POS2126.509 - support for NCR 2126/2127 systems
POS1255.509 - support for NCR 1255 syste

POSxxxx.509 is **NOT** a PC-DOS program and is not executable under DOS.

4.   PC Interface for S509 Card

Mailbox interface

The interface between the PC and the S509 adapter is through a 'mailbox' starting at the first byte of the 8K memory window shared between the card and the PC. Thus for instance, if the S509LOAD is invoked wit **-m** parameter set to C800, address C800:0000 is the start of the POS mailbox.

The mailbox contains three areas - **Execution Flag**, **Card Status Bytes** and **Control Block Structur**.

The card status can be read in the **Card Status Bytes** at any time. This area is updated continually by the coprocessor and tells the user if there are any data queued for reception on an of the ports or if there is free buffer space for asynchronous transmissions.

The card is commanded by filling in the **Control Block Structur** starting at offset 0x10, and then setting the **Execution Flag** at offset 0x00 to 1. When the coprocessor has reset the Execution Flag to 0, the Control Block Structure will have been filled in by the coprocessor, and you can read the Return Code, Data, etc.

Note: Execution Flag must be set to "1" only after all the fields of the   Control Block Structure have been set. If the Execution Flag has   not been reset by the coprocessor within 2 or 3 seconds, the   microcode has hung. This is onl recoverable by reloading the   S509 card.

The S509 mailbox interface is backward compatible with that of S507.

The POS Mailbox is organized as follows:

POS Mailbox

Offset	Size (bytes)	Parameter
0x00	1	Execution Flag
0x01	1	Card Status Bytes: POS Port 1,2 state
0x02	1	Card Status Bytes: Asynch. Port 1,2 state
0x03	13	Reserved
Control Block Structure:		
0x10	1	Command Code
0x11	2	Data Length
0x13	1	Return Code
0x14	1	Port Number
0x15	1	Attribute
0x16	10	Reserved
0x20	1030	Data

Card Status Bytes

By reading the 2 bytes of Card Status, the user can determine quickly if there is any requiremen for further action. Note that reading the Card Status bytes does not involve any setting of the Execution Flag, and is therefore non-intrusive to the S509, and is also fast from the PC point of view.

The meaning of the bytes is as follows:

POS_STATE: Offset 0x02

Bit	Meaning
0	If set, there are data available for reception on POS Port 1.
1	If set, there are data available for reception on POS Port 2.

ASYNC_STATE: Offset 0x03

Bit	Meaning
0	If set, there is data available for reception on Asynch. Port 1.
1	If set, the transmit buffer for Asynch. Port 1 is completely empty.
2	If set, there is data available for reception on Asynch. Port 2.
3	If set, the transmit buffer for Asynch. Port 2 is completely empty.
5	If set, the transmit buffer for Asynch. Port 1 has reached Low Water Mark (i.e. more than 50% of buffer space is empty)
7	If set, the transmit buffer for Asynch. Port 2 has reached Low Water Mark (i.e. more than 50% of buffer space is empty)

Control Block Structure

Field	Offset	Lgth	Remarks
COMMAND	0x10	1	Command code
BUFFER_LENGTH	0x11	2	Length of data buffer associated with this call. The maximum data buffer length is 1030 bytes POS, 1030 bytes asynchronous.
RETURN_CODE	0x13	1	Result of previous command.
PORT_NUMBER	0x14	1	The POS or Asynch port with which this command is associated, i.e. either 0,1 or 2. Commands on port 0 are general commands.
ATTRIBUTE	0x15	1	This indicates whether a received I frame was transmitted by the Controller (Primary) or a Terminal (Secondary). If an I-Frame is received in a string of one or more I-frames headed by an UP frame and terminated by an Abort, PRIM_SEC i set to 0x01. If not, PRIM_SEC is set to 0x00.
RESERVED	0x16-0x1F	10	Reserved for later use.
DATA	0x20	1030	This is the transfer area for passing data to and from the application level.

NOTE: When the data field contains a received frame from the POS system, this includes the entire frame with the exception of leading and trailing flags and the CRC bytes. If a frame is received with a bad CRC, it is discarded.

COMMAND Codes summar

Code	Command
0x01	CONFIGURE
0x02	SEND_ASYNC
0x03	RECEIVE_ASYNC
0x04	ENABLE_POS
0x05	DISABLE_POS
0x06	RECEIVE_POS
0x07	READ_ERROR_STATISTICS
0x08	FLUSH_ERROR_STATISTICS
0x09	GET_STATUS
0x0A	POS_SETUP
0x0B	RESET_CARD

General Return Codes

Although some return codes do have specific meanings for different calls, most of them bear the following general meanings:

Code	Meaning
0x00	Call was successful. All fields of Control Block Structure contain valid data that can be read by an application.
0x01	Call made to an invalid port. Field PORT_NUMBER contained invalid number.
0x02	Call is inappropriate to the port or system state, i.e. the port or system is already in the state commanded.

Code	Meaning
0x03	Port is currently disabled.
0x33	S509 board is busy, e.g. there is no data in receive buffer or transmit buffer is full. Retry the command later.
0x80	Invalid command. Requested command is not recognized.
0x81	Invalid parameter. One of the fields of Control Block Structure contained invalid value.

Note: If the return code other than 0x00 is received, all fields of the Control Block Structure must not be assumed unaltered. It is advised, that you fill all fields of the Control Block Structure each time you issue command to S509 card.

5.   POS Commands

Commands and their formats are identical for all versions of S509 resident code, if not specifically noted otherwise.

Command: CONFIGURE

This command allows to change default S509 configuration such as the number of active asynchronous and POS ports, maximum data buffer size, asynchronous port speed, etc. It is normally done as the first call after card loading or after RESET_CARD command, if configuration other than default is
required.

Default S509 configuration is:
        - number of active POS ports 1
        - number of active Asynch ports   1
        - Asynch port speed   19.2 Kbps
        - Asynch mode   half-duplex

Note that on completion of this command both POS ports are disabled and all data buffers are flushed.

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x01	
BUFFER_LENGTH	0x06	
PORT_NUMBER	0x00	
DATA		Configuration data structure (see next table)

Data field set on entry:

Offset	Lgth	Meaning
0x00	1	This defines the number of active POS lines to be monitored. Valid numbers are 0x01 (default) or 0x02.
0x01	2	Sets the maximum length of the data field. For IBM 4680 and NCR 2126 systems limits the length of an Information Frame. Frames longer than this will be discarded. Valid values are between 128 and 1030 bytes. Default is 265 bytes. For NCR 1255 system limits the number of messages passed to an application during single POS_RECEIVE command. Valid values are between 1 and 1024. Default is 256.
0x03	1	This defines the number of active asynchronous RS485 lines for printers. Valid numbers are 0x01 (default) or 0x02
0x04	1	Sets line speed on the Asynch port(s). 0x01=4800 bps 0x02=9600 bps 0x03=19200 bps (default) 0x04= 38400 bps
0x05	1	Sets asynchronous port mode: 0x00 - full-duplex. 0x01 - half-duplex (default)

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00 0x81	Configuration was successful. Invalid configuration value.
BUFFER_LENGTH	0x00	

Command: SEND_ASYNC

Send a block of data for transmission through one of the Asynch. RS485 ports.

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x02	
BUFFER_LENGTH	As required	The length of the data block to be transmitted. The maximum data length is **1030** bytes.
PORT_NUMBER	1 or 2	
DATA		The data to be transmitted.

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00	The data has been queued for transmission.
		The port number selected is invalid
	0x01	
	0x33	The data was not queued due to the fact that there was no sufficient free space in transmit buffer. **No data was sent to the S509 card and this same data should be re-sent in its entirety after a short delay**. Note that by reading the ASYNC_STATE byte of the Card Status Bytes, you can te when the Asynch. buffer is completely empty.
		BUFFER_LENGTH exceeds Asynch. transfer block limit.
	0x81	
BUFFER_LENGTH	0x00	

Command: RECEIVE_ASYNC

Receive a block of data that has been buffered from one of the Asynch. RS485 ports.

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x03	
BUFFER_LENGTH	0x00	
PORT_NUMBER	1 or 2	

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00	Data has been received from an Asynch port and is available for pick up in the DATA field of the structure.
	0x01	The port number selected is invalid.
	0x33	No data is available on the selected port.
BUFFER_LENGTH	As se	The length in bytes of the data received (maximu 1030). This is valid if a **RETURN_CODE** of **0x00** is received.
DATA		The data that has been received on the selected Asynch. port. This is valid if a **RETURN_CODE** of **0x00** is received.

Command: ENABLE_POS

Enable POS port and start listening on a POS line.

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x04	
BUFFER_LENGTH	0x00	
PORT_NUMBER	1 or 2	

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00 0x01 0x02	Action performed successfully. The port number selected is invalid. Port already enabled.
BUFFER_LENGTH	0x00	

Command: DISABLE_POS

Disable POS port and stop listening on a POS line.

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x05	
BUFFER_LENGTH	0x00	
PORT_NUMBER	1 or 2	

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00 0x01 0x02	Action performed successfully The port number selected is invalid. Port already disabled.
BUFFER_LENGTH	0x00	

Command: RECEIVE_POS

Receive a frame of data that has been buffered from one of the POS synchronous loops.

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x06	
BUFFER_LENGTH	0x00	
PORT_NUMBER	1 or 2	

Control Block values set on return:

Field	Value	Meaning
RETURN_CODE	0x00	For IBM 4680 and NCR 2126 systems a frame is available for pick up in the DATA field of the structure.
		For NCR 1255 at least one message is available for pick up in the DATA field of the structure.
	0x01 0x03 0x33	The port number selected is invalid. The port is disabled. No data is available on the selected port.
ATTRIBUTE	0x00 0x01	Controller frame (Primary). Terminal frame (Secondary). **Note:** this field is valid only for the IBM 4680 code version.
BUFFER_LENGTH	As se	The size of data block available for pick up in the DAT field. This is valid if a **RETURN_CODE** of **0x00** is received.
DATA		The next portion of data that has been received on the selected POS port (see notes). This is valid if a **RETURN_CODE** of **0x00** is received.

Notes:

For the IBM 4680 and NCR 2126/2127 systems POS data is passed on to an application one frame at a time. The frame includes both address and control fields exactly as received on the line. The CRC bytes are not included. Frames with bad CRC are discarded.

For the NCR 1255 system POS data is passed on to an application as a block of messages. Only Exchange, Re-exchange and Data messages are accepted by the S509 card. Each message occupies 2 consecutive bytes and consists of the message identification byte, followed by the data byte. The message identification byte has the following format:

Bit	Meaning
0 - 3	Register ID, as defined by the NCR 1255 specifications
4 - 6	Register Sub-ID, as defined by the NCR 1255 specifications
7	Message attribute: 0 - message originated by register (Data message). 1 - message originated by controller (Exchange or Re-exchange message).

Number of messages in the DATA field can be calculated as a value of the BUFFER_LENGTH field divided by two.

Command: READ_ERROR_STATISTICS

Retrieve the communications error statistics for the POS port(s).

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x07	
BUFFER_LENGTH	0x00	
PORT_NUMBER	1 or 2	

Control Block values set on return:

Field	Value	Meaning
RETURN_CODE	0x00	The action was performed successfully.
BUFFER_LENGTH	0x08 0x00	Size of Error Statistics data structure (if a **RETURN_CODE** of **0x00** is received). If error
DATA		Error Statistics data structure (see following table). Valid only if **RETURN_CODE** of **0x00** is received.

Data field set on return:

Offset	Lgth	Meaning
0x00	2	Number of receiver overrun errors.
0x02	2	Number of receiver CRC errors. (Not valid for NCR 1255 code version).
0x04	2	Number of abort frames received. (Not valid for NCR 1255 code version).
0x06	2	Number of frames lost due to the buffers being overwritten. The S509 card has considerable buffer space, but if it is not serviced regularly, buffer overwrites will occur.
0x08	2	Number of frames received of excessive length. These frames are discarded. (Not valid for NCR 1255 code version).

Command: FLUSH_ERROR_STATISTICS

The current values of the variables accessed by the **READ_ERROR_STATISTICS** command
are reset to zero.

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x08	
BUFFER_LENGTH	0x00	
PORT_NUMBER	0	

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00	The action has been performed successfully.

Command: GET_STATUS

Interrogate the S509 to find out if any data are available for reception, or if Asynch. data may be transmitted.

Control Block values to be set on entry:

Field	Value	Remarks
COMMAND	0x09	
BUFFER_LENGTH	0x00	
PORT_NUMBER	0	

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00	The action has been performed successfully
BUFFER_LENGTH	0x0C	Size of Status data structure. This is valid only if a **RETURN_CODE** of **0x00** is received
DATA		Status data structure (see following table). This is valid only if **RETURN_CODE** of **0x00** is received

Data field set on return:

Offset	Lgth	Meaning
0x00	2	Number of frames queued for reception from POS port 1
0x02	2	Number of frames queued for reception from POS port 2
0x04	2	Number of bytes available for reception from Asynch port 1. If the number of received bytes exceeds 1030, this value will be 1030.
0x06	2	Number of bytes available for transmission on Asynch port 1, maximum 1030 bytes. The calling program can send a block o asynchronous data to the port of at least this size without getting a return code of 0x33.
0x08	2	Number of bytes available for reception from Asynch port 2. If the number of received bytes exceeds 1030, this value will be 1030.
0x0A	2	Number of bytes available for transmission on Asynch port 2, maximum 1030 bytes. The calling program can send a block o asynchronous data to the port of at least this size without getting a return code of 0x33.

Command: POS_SETUP

Setup POS filtering. This command allows to change filtering dynamically. No data queued in the POS received buffers is lost as a result of this command.

The POS Setup data structure placed into DATA field depends on the POS system.

Control Block values to be set on entry for IBM-4680 and NCR-2126:

Field	Value	Remarks
COMMAND	0x0A	
BUFFER_LENGTH	3	Size of POS Setup data structure. For the IBM 4680 and NCR 2126/2127
	257	For the NCR 1255 syste
PORT_NUMBER	0	
DATA		POS Setup data structure (see the following table).

For the IBM 4680 and NCR 2126/2127 systems the data field setup on entry is as follows:

Offset	Lgth	
0x00	1	Filtering mode: 0 - Disable filtering (i.e. all received data are passed to an application, including Supervisory frames, Unnumbered frames, etc.) 1 - Pass I-frames only. All non I-Frames are discarded. This is the default mode. 2 - Pass only I-frames matching an address specified at offset 0x01.
0x01	2	Address match for selected I-frames. Note: This field is valid only if the value at offset 0x00 equals 2.

For the NCR 1255 system the data field setup on entry is as follows:

Offset	Lgth	
0x00	1	Filtering mode: 0 or 1 - Disable filtering (i.e. all received messages are passed to an application). 2 - Enable filtering. Pass only messages originated by a source with non-zero entry in filtering table specified at offset 0x01.
0x01	256	Filtering table. Note: This field is valid only if the value at offset 0x00 equals 2.

For the NCR 1255 system filtering is done based on the message origin, i.e. Terminal ID, Sub-ID and its direction (Terminal or Controller), which is uniquely represented by the message identification byte (the first byte of the message).

Setup data structure contains an array of 256 bytes at offset 0x01. Each byte of the filtering table represents one of 256 possible message origins. Entries with a values set to zero cause messages with corresponding message identification bytes to be filtered out.

Index of the filtering element for a given message is calculated as

$$16 \times \text{Sub-ID} + \text{TerminalID}$$

for terminal messages, and

$$128 + 16 \times \text{Sub-ID} + \text{TerminalID}$$

for controller messages.

If, for example, messages from terminal 10, Sub-ID's 2 and 3 are to be filtered out, then you w have to set bytes at offsets 42 and 58 of the filtering table to 0 ($16 \times 2 + 10 = 42$, $16 \times 3 + 10 = 58$).

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00	The action has been performed successfully.

Command: RESET_CARD

This is 'warm' reset. All buffers are cleared, on-board logic is re-initialized and default configuration is restored. This command is useful when it is necessary to restore a default card state or recover from a hardware failure without reloading the card.

Note that this command will not help if card is not responding, i.e. a software failure has occurred. You will have to reload the card in this case.

Field	Value	Remarks
COMMAND	0x0B	
BUFFER_LENGTH	0x00	

Control Block values set on return:

Field	Value	Remarks
RETURN_CODE	0x00	The action has been performed successfully
BUFFER_LENGTH	as se	Length of code identification string (including terminating zero). This is valid only if a **RETURN_CODE** of **0x00** is received
DATA		Code identification string (in ASCIIZ format). This is valid only if **RETURN_CODE** of **0x00** is received

6.   S509LOAD Error Messages and Exit Codes

If S509LOAD does not execute successfully, an error message will be displayed and an exit code other than zero will be returned to the parent DOS process. The exit code can be examined (i.e. with DOS ERRORLEVEL command) and appropriate action taken. The error messages and corresponding exit codes are as follows:

Code	Message
1	**Invalid command line syntax** Invalid command line argument or parameter was used.
2	**Invalid adapter configuration** At least one of the adapter configuration parameters specified in command line is out of range.
3	**Memory allocation failure** Unable to allocate memory needed to read an S509 code file.
4	**Cannot open a file or file too big** S509 code not found, cannot be read or exceeds 64K.
5	**Card is not found** S509 is not found at specified I/O address.
6	**Memory conflict** Memory area designated for S509 shared memory window is not available (used by other hardware or software).
7	**Adapter memory failure** On-board RAM test failed.
8	**Failed to load adapter code** Error was found comparing code loaded onto card with contents of the code file.
9	**Adapter hardware failure** S509 board logic failure was detected.
10	**Adapter software failure** S509 code is not running or is hung.