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IBSM

Installation and Programming Manual

This Manual describes the IBSM InterBus-S Master, its uses and set up. It also describes the use of the IBSM configuration software.

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NR&D

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1
Introduction

The Niobrara IBSM (InterBus-S Master) is a SY/MAX® compatible module that performs the function of Host Controller on an InterBus-S network. The IBSM interfaces with the SY/MAX PLC through the Square D SY/MAX register rack to provide access to the InterBus-S devices through the backplane. The IBSM PLUS provides the same features of the IBSM with a guaranteed 16 bit-wide SY/MAX interface to the PLC.

Communication with the InterBus-S devices is through an isolated RS-485 InterBus-S Remote Bus connector on the front panel of the module.

All data is stored in the IBSM in standard 16 bit SY/MAX compatible registers. The IBSM has 8192 registers which are divided into ranges for the PLC Rack Interface, InterBus-S Inputs, InterBus-S Outputs, InterBus-S Configuration, InterBus-S Statistics, IBSM Control and Status, and the IBSM Mapper. Table 1-1 displays this information.

Table 1-1 IBSM Register Grouping

Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

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The Mapper is the key to the IBSM. The IBSM runs the InterBus-S network and sets the InterBus-S Outputs based on values in its InterBus-S Output register area. InterBus-S Inputs are consequently placed in the module's InterBus-S Input registers. The Mapper provides the mechanism for transferring these InterBus-S I/O values to and from the PLC rack. With certain restrictions, the Mapper is capable of copying register data from any location in the IBSM to any other location in the IBSM. This allows the mapping of PLC Outputs to InterBus-S Outputs, InterBus-S Inputs to PLC Inputs, InterBus-S Inputs to other InterBus-S Outputs, IBSM control and statistics registers to and from the PLC rack, etc. The Mapper provides complex manipulations including bit masking and bit rotations.

The configuration of the module is accomplished by setting parameters in the registers in the IBSM. This is most easily accomplished with the use of the IBSMSW.EXE program. This MS-DOS program provides a convenient interface for configuring and troubleshooting the IBSM. This software is provided free of charge with the IBSM.

Specifications

Module Specifications

Mounting Requirements

One register slot of a Square D Class 8030 Type CRK, DRK, GRK, HRK, or RRK I/O or the NR&D NRK2 rack assembly.

Current Draw on SY/MAX power supply

1100 mA

Operating Temperature

0 to 60 degrees C operating. -40 to 80 degrees C storage.

Humidity Rating

up to 90% noncondensing

Pressure Altitude

-200 to +10,000 feet MSL

InterBus-S Communication Port

9 pin D-connector, optically isolated RS-485 compatible. Fixed 500K baud InterBus-S protocol.

SY/MAX Communication Port

9 pin D-connector, RS-422/485 compatible. Selectable baud rate, parity, error check.

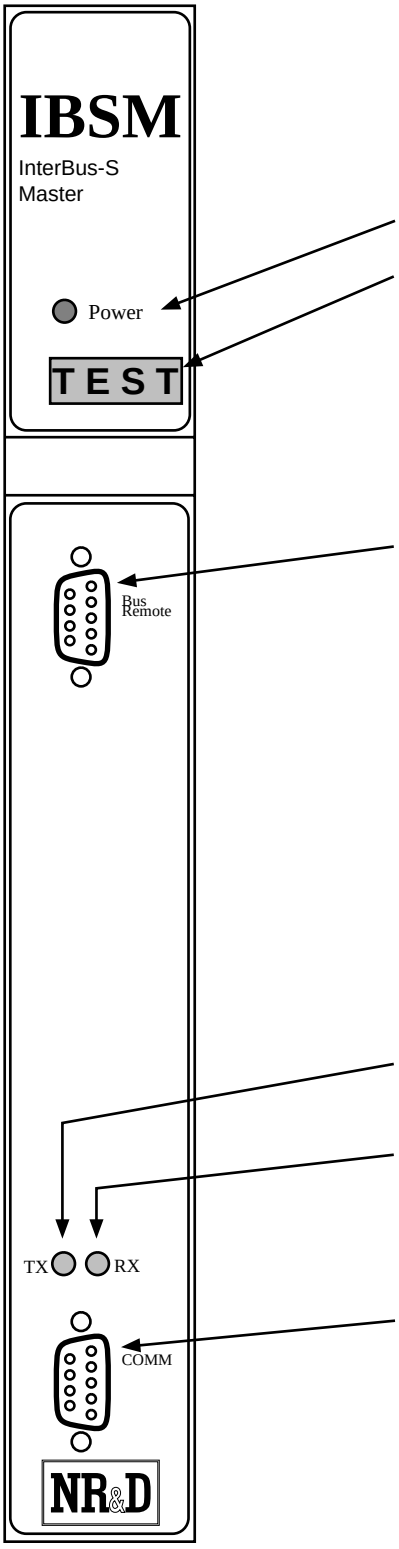
Indicator lights

3 LEDs: Green Power, Yellow SY/MAX port RX, and TX.
1 Four Character red LED Message Display.

Physical Dimensions

Single width module.
Wt: 2.5 lb.
W: 1.5 in.
H: 12.8 in.
D: 6.6 in.

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Mode Indicators

Power (Green) - lights when module is powered.

Status (Red LED array) - Alphanumeric message display for module status information.

Remote Bus Port

InterBus-S standard 9-pin D-subminiature connection to remote bus.

Communication Indicators (LEDs)

TX (Yellow) - Lights when data is being transmitted from COMM port.

RX (Yellow) - Lights when data is being received at COMM port.

COMM Port

Female SY/MAX compatible RS-422 communication port. This port is also used for field downloading of new firmware into the module.

Figure 1-1 IBSM Front Panel

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2

Installation

Warning

Do NOT install or remove the IBSM with power applied to the Rack. Turn OFF power at the power supply. Damage to the equipment may occur if the power is on during installation.

Module Installation

1 Remove power from the rack.

2 Mount the IBSM in an available slot in the register rack. Secure the screw at the bottom of the module.

3 Apply power to the rack. The green power light should illuminate and remain lit. The four character display should quickly flash the following messages: TEST, RAM1, RAM2, ROM1, ROM2, PASS, and then may display any of several messages including: OPEN, SLER, RUN, HALT, DSBL, CFIG depending upon the exact configuration. If the message area displays LOAD, remove power, remove the module from the rack, locate the LOAD/NORMAL switch on the back of the module, move the switch to the NORMAL position, reinstall the IBSM, and restore power. (See Appendix A on page 53 for a complete listing of messages.) The lights above the 9 pin RS-422 COMM port on the illuminate only when data is passing through the port.

NOTE: If the slot that the IBSM occupies has been rack addressed by the PLC and an error message such as OPEN or CFIG is displayed on the IBSM, the PLC will likely display an I/O Error and go into Halt. This is an example of the BUS error feature of the IBSM. When a PLC BUS error occurs, Register 8175 in the PLC will display the decimal number 19000 + First register rack addressed to the module. For example, the IBSM is in a slot rack addressed from 640 to 675.

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When a bus error occurs, the decimal value 19640 will appear in PLC register 8175. The IBSM may be configured such that this feature is disabled.

4 The IBSM will default to the settings held in non-volatile RAM. Factory default settings are shown in Table 2-1.

Table 2-1 IBSM Factory Default Settings

Parameter	RS-422 COMM Port
Mode	SY/MAX
Baud Rate	9600
Parity	EVEN
Data Bits	8
Stop Bits	1
Checksum	BCC

IBSMSW Software Installation

This MS-DOS compatible program runs on an IBM compatible personal computer. The software is distributed on a 3.5" 720K floppy and is compressed using an industry standard .ZIP format. For automatic installation perform the following steps.

1 Insert the floppy into a drive and run the INSTALL program from that drive.

2 Enter the floppy drive name that contains the distribution disk.

3 Select IBSMSW from the list of softwares to install.

4 Enter a directory name to install the IBSMSW software. It is recommended that a directory IBSM be used for the installation on your hard drive.

5 Once INSTALL is finished copying and expanding the files, exit by pressing the ESC key until the DOS prompt is reached.

6 Change to the IBSM directory and perform a directory with the following commands:

```
C:
CD \IBSM
DIR
```

Table 2-2 lists the files that should appear in the directory. These files are described in Chapter 4 on page 31.

Table 2-2 IBSM Software List

File Name	Description
IBSMSW.EXE	IBSM Configuration Software.
IBSM.ICO	Icon for IBSMSW for Windows.
IBSM.FWL	Downloadable firmware for the IBSM.

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Serial Connection to the IBSM

A physical connection must be made from the personal computer to the IBSM in order for IBSMSW to be able to fully function. This link may be a serial connection from a COM port on the personal computer to the RS-422 port on the IBSM. Usually an RS-232 to RS-422 converter is required for this connection and the Niobrara SC902 (or SC406) smart cable is recommended. If the personal computer has a SY/LINK card, the RS-422 port on the SY/LINK card may be used to directly connect to the IBSM. Refer to page 46 for additional information on the SY/LINK setup.

Connect your personal computer to the IBSM. It is assumed here that this connection will be made from COM1: of the personal computer using an SC902 Smart Cable.

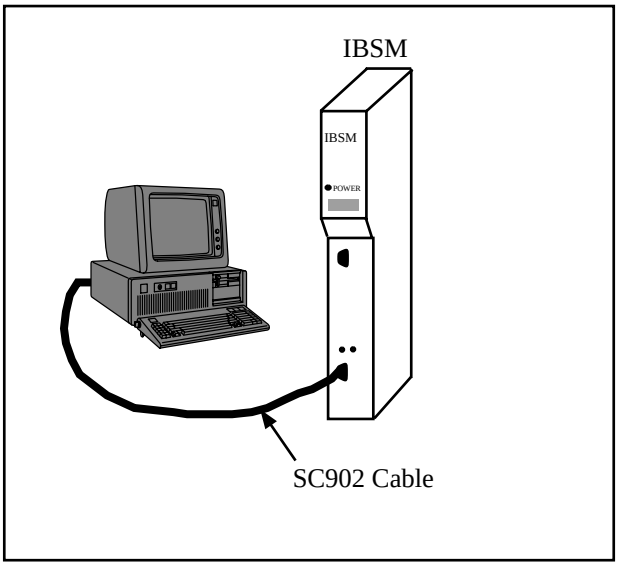


Figure 2-1 IBSM initialization

Start IBSMSW.EXE to communicate with the IBSM in SY/MAX mode.

C:\IBSM> IBSMSW

The screen should appear as in Figure 2-2.

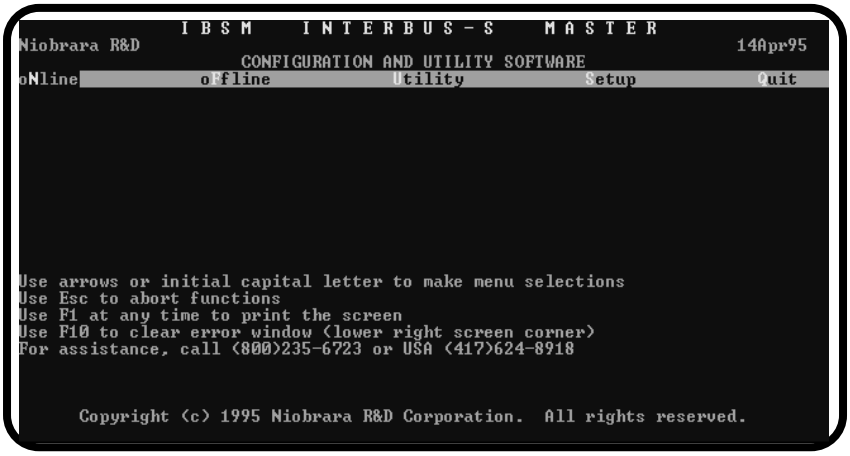


Figure 2-2 IBSMSW Main Menu

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In order to communicate with the IBSM, the personal computer must be configured to match the communication parameters of the IBSM. This is accomplished using the SY/MAX Setup screen within IBSMSW.

1 From the Main menu, press "S" for Setup.

2 From the Setup menu, press "S" for Sy/Max setup. A window should open as in Figure .

3 At this point, set the parameters according to the local requirements. For a direct connection with an SC902 cable and COM1: the following parameters are suggested:

a. Connection type Sy/Max COM:

b. Port COM1:

c. Baud Rate 9600

d. Data Bits 8

e. Stop Bits 1

f. Parity EVEN

g. Error Check BCC

h. Route NONE

4 After Entering the Route, a confirmation window will appear to prompt the user to save the setup to disk. Select "Y" for Yes.



Figure 2-3 Sy/Max Setup Window

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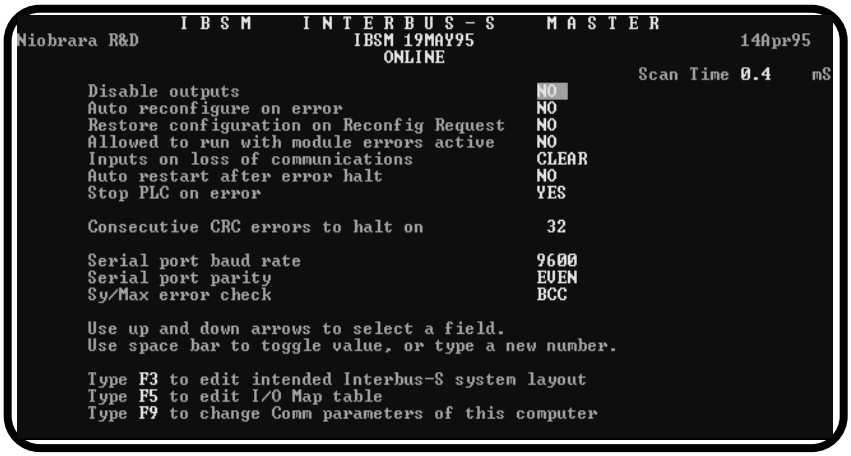


Figure 2-4 IBSMSW oNline Edit

The personal computer is now ready to communicate with the IBSM. Press "N" for oNline followed by "E" for Edit and the TX and RX lights on the IBSM should start flashing. The screen on the personal computer should look something like Figure 2-4. The arrow keys are used to move the cursor around. Parameters may be changed by toggling values with the space bar, - and + keys, or by direct entry of numeric fields. Use caution while changing fields that relate to the RS-422 Port; communication may be interrupted if values such as baud rate, parity, or checksum are changed while on-line.

IBS installation

The IBSM connects to the InterBus-S network using its Remote Bus port. The IBSM uses the 2 Twisted-Pair Remote Bus Wiring scheme and the pinout of its 9 pin port is compatible with Pheonix Contact products.. Connection to the first Remote Bus device with a proper remote bus cable such as the Niobrara IR9D cable shown on page 52. For a complete IBS overview see the Phoenix Contact document: InterBus-S Instruction Manual IBS SYS INST UM E Order No.: 27 54 804. This document may be ordered from Pheonix Contact.

Connect an IBS network to the IBSM. The front display should change from OPEN or SLER to CFIG. The CFIG message indicates that actual layout of the network does not match the intended layout. Since there is probably no intended layout stored in the IBSM, this means that the IBSM is at least communicating with the first remote bus module.

At this point, go oNline and Edit the Intended Layout. The F2 key allows an easy way to copy the actual layout to the intended layout. After copying the actual layout to the intended layout, leave this screen by pressing ESC and after the configuration is modified, the CFIG message should change to HALT. If the PLC is then placed in RUN mode, the I/O error should be removed from the PLC and the IBSM will display RUN. The IBS is now operating and it is ready for use.

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3

Operation

InterBus-S Overview

The InterBus-S sensor/actuator network operates in a manner that is effectively a large shift register. The IBSM keeps a table of registers that corresponds to all of the output bits on the InterBus-S network. The IBSM also keeps a table that corresponds to all of the input bits on the IBS network. During a normal scan of the IBS network, the IBSM clocks output data to the network modules while the modules clock their input data to the IBSM. Each device on the IBS network checks the integrity of the data with CRC calculations between nodes. The data must pass all checks around the loop before it is allowed to be latched in the outputs or placed in the IBSM's input table.

This structure requires the IBSM and all of the modules on the IBS network to know the size of the network. This is accomplished by the IBSM issuing an ID cycle. The ID cycle information allows the IBSM to know the exact I/O module type and position on the bus. The IBSM keeps a table of the current bus layout and compares the current bus to a table that contains the intended bus layout. If the tables do not match, the IBSM will halt the IBS network and, depending on its configuration, may cause a PLC bus error to halt the PLC.

The IBS serial protocol is implemented in two formats: remote bus and local bus. Both of these bus types operate in the same manner for shifting the data but differ in transmission distance.

The remote bus operates at differential RS-485 levels for long distance communication of up to 1300 feet. Up to 32 remote bus devices may be connected to a single master. Only serial communication is passed through the remote bus cable. Each remote bus device is independently powered as no power passes through the remote bus. The IBSM has a remote bus port and acts as the start of the remote bus. Remote bus devices are available that act as local bus terminals with and without I/O.

The local bus is intended for localized areas of I/O. The local bus is limited to 8 modules with a maximum cable length of 32 feet. The communication ports of each local

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bus device are powered by the remote bus terminal. The communication levels are TTL on the local bus.

Figure 3-1 below shows a typical IBS network with 3 local bus groups. Group 1 consists of (1) a bus terminal without I/O, (2) a 16 bit digital input module and (3) a 16 bit digital output module. Group 2 has (4) a bus terminal with 16 bits of input and 16 bits of output, (5) a 16 bit digital input module, (6) a four channel analog input module, and (7) a four channel analog output module. Group 3 contains (8) a remote terminal without I/O, (9) (10) two 16 bit digital outputs, (11) one 16 bit digital input, and (12) another 16 bit digital output.

In the following configuration examples Figure 3-1 will be used for the sample data.

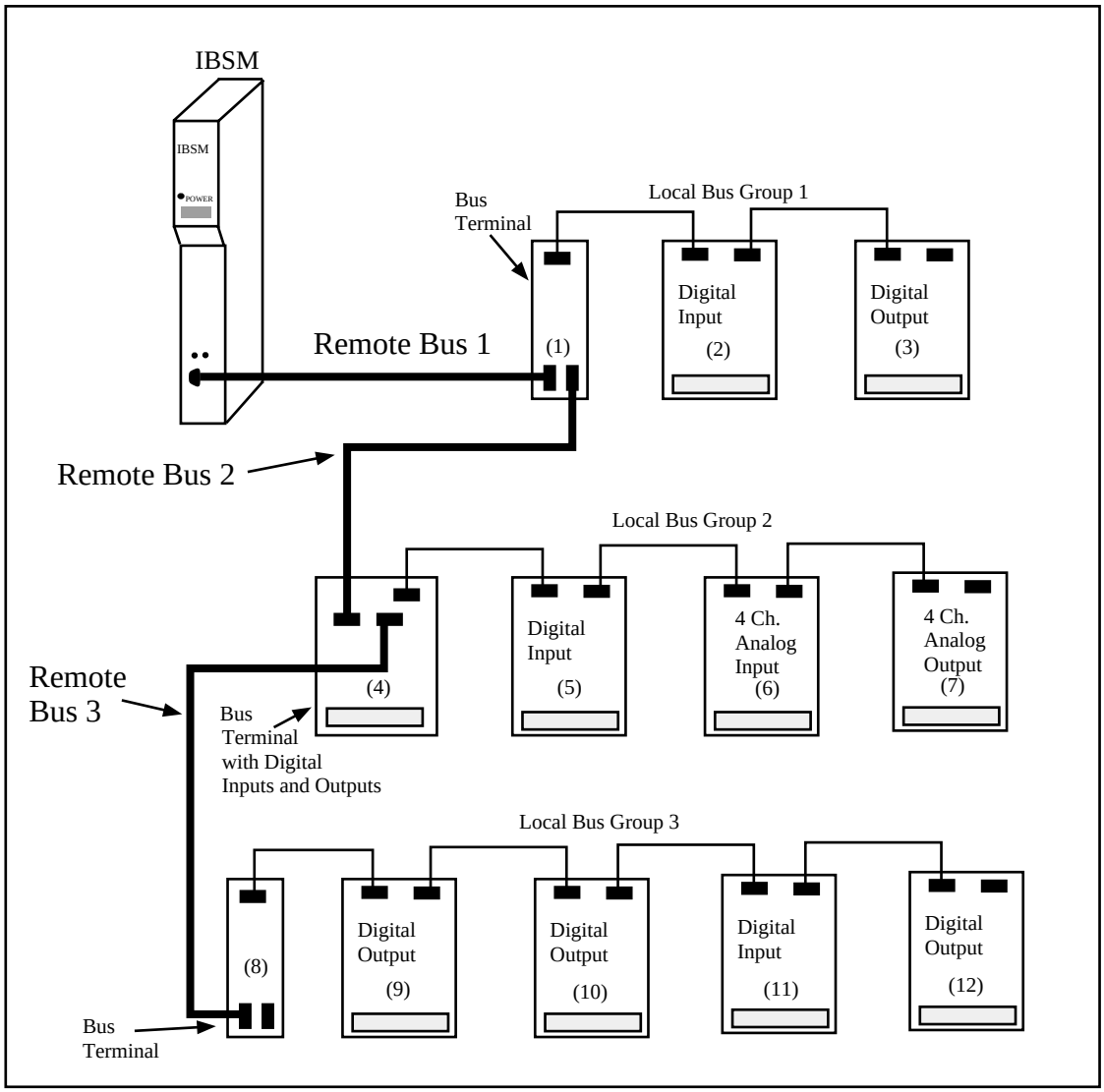


Figure 3-1 IBS example

Memory Configuration

The operation of the IBSM is determined by the configuration in its memory. The IBSM's internal user-accessible memory is represented as SY/MAX processor equivalent registers. All configuration parameters are stored and displayed in these registers. A list of available registers is shown in Table 3-1.

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Table 3-1 IBSM Register List

Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

PLC Rack Addressable Area

IBSM registers 1..512 are rack addressable by the SY/MAX PLC. The ability of the PLC to write these registers is controlled by the Mapper in the IBSM. By default these registers are PLC outputs and the PLC can write values to these registers. PLC outputs may be identified by their status register value since they have bits 14 and 16 set (A000 hex).

The IBSM Mapper determines which registers are read only to the PLC. If the target register of in a Map is located in the rack addressable area, the target register is changed from a PLC output to a PLC input. Its status register will now have bits 14, 15, and 16 set (E000 hex).

Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

Table 3-2 PLC Rack Area

Register	Function	Status
1	PLC Output	A000
2	PLC Output	A000
3	PLC Output	A000
4	PLC Output	A000
5	PLC Input	E000
6	PLC Input	E000
7	PLC Input	E000
8	PLC Output	A000
9	PLC Output	A000
...	...	...
512	PLC Output	A000

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InterBus-S Inputs

Registers 513..768 provide the input values from the IBS devices. The registers correspond to the IBS devices starting from the bus terminal closest to the IBSM, then the local devices on that bus from the closest device to the terminal, then the next remote bus and its local devices, all the way to the farthest device from the IBSM. Notice that all InterBus-S devices have the same number of logical inputs and outputs. Some devices such as bus terminals do not have any inputs while other devices have multiple registers of inputs. Input registers corresponding to output only devices are not used and any data that may reside in these registers is not to be used for control purposes.

If IBSM register 1795 bit 5 (R[1795].5) is clear and the IBS network stops, R[513] through R[768] will be set to zero by the IBSM. If R[1795].5 is set and the bus stops, the values in R[513]...R[768] will remain unchanged from the last scan.

Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

Table 3-3 IBS Inputs

Register	IBS Module	Function
513	(2)	Input Word
514	(3)	Not Used
515	(4)	Input Word
516	(5)	Input Word
517	(6)	Ch. 1 Input Word
518		Ch. 2 Input Word
519		Ch. 3 Input Word
520		Ch. 4 Input Word
521	(7)	Ch. 1 Not Used
522		Ch. 2 Not Used
523		Ch. 3 Not Used
524		Ch. 4 Not Used
525	(9)	Not Used
526	(10)	Not Used
527	(11)	Input Word
528	(12)	Not Used
...		...
768		Not Used

InterBus-S Outputs

Registers 769..1024 provide the output values for the IBS devices. The registers correspond to the IBS devices starting from the bus terminal closest to the IBSM, then the local devices on that bus from the closest device to the terminal, then the next remote bus and its local devices, all the way to the farthest device from the IBSM. Notice that all InterBus-S devices have the same number of logical inputs and outputs. Some devices such as bus terminals do not have any outputs while other devices have multiple registers of outputs. Output registers corresponding to input only devices are not used.

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The actual values sent on the IBS bus depend upon several factors. If there are no errors on the bus and the PLC is in run, and R[1795].1 is cleared, the values in R[769] through R[1024] are sent to the appropriate IBS device. If the bus stops, the devices should reset to their communication loss default output level. (Check the documentation for the output device to determine this state.) If the PLC is placed in Disable Outputs mode, the values in R[769]...R[1024] will reflect the current mapping but the IBSM will send zeros to the actual output devices. Setting bit 1 of R[1795] has the same effect as placing the PLC in Disable Outputs.

Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

Table 3-4 IBS Outputs

Register	IBS Module	Function
769	(2)	Not Used
770	(3)	Output Word
771	(4)	Not Used
772	(5)	Output Word
773	(6)	Ch. 1 Gain Word
774		Ch. 2 Gain Word
775		Ch. 3 Gain Word
776		Ch. 4 Gain Word
777	(7)	Ch. 1 Output Word
778		Ch. 2 Output Word
779		Ch. 3 Output Word
780		Ch. 4 Output Word
781	(9)	Output Word
782	(10)	Output Word
783	(11)	Not Used
784	(12)	Output Word
...		...
1024		Not Used

Intended IBS Layout

Registers 1025 through 1281 contain the intended layout of the IBS system. R[1025] provides the intended number of modules in the IBS network. Registers 1026...1281 indicate the characteristics of each of the 256 possible devices on the bus with one module ID code per word.

- Bits 1..8 identify the module type.
- Bits 9..13 identify the number of input and output bits supported by the module.
- Bits 14, 15, and 16 encode special instructions to bus terminals.
  - — Set bit 14 to disable the local bus of a bus terminal.
  - — Set bit 15 to disable the remote bus downstream of a bus terminal.
  - — Set bit 16 to operate the alarm relay in a bus terminal.

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When the local or remote bus outputs of a bus terminal are disabled, the module will ignore the entries in the intended layout corresponding to the isolated modules. It is not necessary to modify the intended layout to reflect the truncated system configuration. The actual layout registers will describe the truncated configuation. Do not disable the remote bus output of the last bus termianl. The same commands can be transmitted to a non-bus terminal modules but are normally ignored.

Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

Table 3-5 Intended IBS Layout

Reg.	IBS Module	Value (hex)	Value (dec)	Description
1025		000C	12	# of modules
1026	(1)	0034		IBS 24 BK-T
1027	(2)	xx96		IBS 24 DI/LC
1028	(3)	xx95		IBS 24 DO/LC
1029	(4)	xx0F		IBS 24 BK-I/O-T
1030	(5)	xx96		IBS 24 DI/LC
1031	(6)	xx43		IBS AI
1032	(7)	xx41		IBS AO 1
1033	(8)	0034		IBS 24 BK-T
1034	(9)	xx95		IBS 24 DO/LC
1035	(10)	xx95		IBS 24 DO/LC
1036	(11)	xx96		IBS 24 DI/LC
1037	(12)	xx95		IBS 24 DO/LC
...		...	...	
1024	...	0	0	...

Actual IBS Layout

Registers 1282 through 1538 contain the actual layout of the IBS system. R[1282] provides the actual number of modules in the IBS network. Registers 1283...1538 indicate each of the 256 possible devices on the bus with one module ID code per word.

- Bits 1..8 identify the module type.
- Bits 9..13 identify the number of input and output bits supported by the module.
- Bits 14, 15, and 16 show module messages when the bus is properly connected.

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Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

Table 3-6 Actual IBS Layout

Reg.	IBS Module	Value (hex)	Value (dec)	Desc.
1025		000C	12	# of modules
1026	(1)	0034		IBS 24 BK-T
1027	(2)	xx96		IBS 24 DI/LC
1028	(3)	xx95		IBS 24 DO/LC
1029	(4)	xx0F		IBS 24 BK-I/O-T
1030	(5)	xx96		IBS 24 DI/LC
1031	(6)	xx43		IBS AI
1032	(7)	xx41		IBS AO 1
1033	(8)	0034		IBS 24 BK-T
1034	(9)	xx95		IBS 24 DO/LC
1035	(10)	xx95		IBS 24 DO/LC
1036	(11)	xx96		IBS 24 DI/LC
1037	(12)	xx95		IBS 24 DO/LC
...		...	...	
1024	...	0	0	...

Module Error Counters

Registers 1539 through 1793 provide a count of the number of module errors on each of the possible IBS modules. The least significant byte, LSB, counts the CRC errors. The IBSM automatically acknowledges module errors. Few (if any) IBS modules support acknowledgment so it is normal for the module error counter to increment continuously in the presence of a module error.

IBSM Error Counter

Register 1794 provides the IBSM error counter. The LSB counts CRC errors in the last hop on the network.

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Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

Table 3-7 IBS Module Errors

Register	IBS Module
1539	Module 1
1540	Module 2
1541	Module 3
1542	Module 4
...	...
1793	Module 256
1794	IBSM Error

IBSM Option Register

Register 1795 provides a bit map of various options for the IBSM.

- Bit 1 - Set to disable InterBus outputs. Clear if outputs should follow image registers, error conditions permitting. The output image registers 769 through 1024 remain active.
- Bit 2 - Set if IBSM is allowed to attempt reconfiguration (and set appropriate downstream disable bits in the intended layout) when bus segments are missing or not responding.
- Bit 3 - Set if IBSM should initiate reconfiguration (by clearing all downstream disable bits in the intended layout) when a reconfigure request is received from a bus terminal.
- Bit 4 - Set if bus is allowed to run when a module error is active.
- Bit 5 - Set if inputs from IBS freeze on loss of communication. If clear, inputs are reset on loss of communication.
- Bit 6 - Set if the IBSM should not attempt to recover after a bus halt. If set, R[1795].1 must be set and then cleared to restart a bus halted by an error. If clear, the IBSM will automatically switch the bus from halt to run anytime it is possible to do so.
- Bit 7 - Set if IBSM should NOT generate PLC bus faults when the IBS is halted.
- Bit 14 - Set if IBSM PLUS setup protection is enabled. If this bit is ON then the IBSM PLUS must be halted before it accepts configuration changes through the SY/MAX serial port or through the backplane. The Password Registers 1806 and 1807 control access to this options register.
- Bit 15 - Set if DEA special support is required. Consult the Factory for more info.
- Bit 16 - Set if IBSM should run continuous ID cycles. This is intended for factory testing. Users should Set 1795.1

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Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

Table 3-8 IBSM Configuration

Register	Description
1795	IBSM Options
1796	Module Error Limit
1797	COMM Parameters
1798	IBSM Status
1799	IBS "Health"
1800	Misc. IBSM Errors
1801	IBS Scan Time
1802	Ring Word Size
1803	Failed Terminal Number

CRC Error Limit

Register 1796 sets the number of consecutive CRC errors that will halt the bus and signal the PLC CPU.

COMM Parameters

Register 1797 controls the configuration of the RS-422 SY/MAX port.

- Bits 1,2,3,4 - These bits determine the baud rate of the SY/MAX port. See Table 3-9.
- Bit 9 - Set for no parity, clear for even parity.
- Bit 10 - Set for two-byte CRC, clear for one-byte BCC error checking.

Table 3-9 COMM Port Baud Rates

Bit Pattern 4321	Baud Rate		Bit pattern 4321	Baud Rate
0000	50		0111	1200
0001	75		1000	1800
0010	110		1001	2400
0011	134.5		1011	4800
0100	150		1100	7200
0101	300		1101	9600
0110	600		1111	19200

Any other value will select 9600 baud.

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IBSM Status Register

Register 1798 displays the status of the IBS network.

- Bit 1 - Set if IBS ID cycles show the ring is complete.
- Bit 2 - Set if IBS layout matches intended system layout.
- Bit 3 - Set if IBS is running and outputs are valid on all modules.
- Bit 4 - Set if IBS is running and inputs from the bus are valid.
- Bit 7 - Set if there is a failure in the remote bus. Register 1803 displays the last functioning bus terminal.
- Bit 8 - Set if there is a failure in the local bus. Register 1803 displays the last functioning bus terminal.
- Bit 9 - Set if any module reports a module error.
- Bit 10 - Set if any module requests reconfiguration. If R[1795[.2 is clear, bit R[1798].10 must be cleared by the host.
- Bit 11 - Set if bus is halted because of timeouts, as from an open cable.
- Bit 12 - Set if bus is halted because of module CRC errors.
- Bit 13 - Set if bus is halted because of last hop CRC errors.
- Bit 14 - Set if map is too complex for minimum latency.

Register 1810 provides a "sticky" version of the error bits of register 1798.

IBS Health Register

Register 1799 provides a "Health" value for the network. The value ranges from 0 to 1000 with 1000 being the best. This is the number of the last 1000 scans that were error free.

Miscellaneous IBSM Errors

Register 1800 provides additional IBSM error messages.

- Bit 1 - CPU error.
- Bit 2 - ROM error.
- Bit 3 - RAM error.
- Bit 4 - Illegal parameter in intended layout.
- Bit 5 - InterBus interface failure.
- Bit 6 - Illegal register number in map.

IBS Scan Time

Register 1801 provides the scan time for the IBS network in tenths of milliseconds.

IBS Ring Word Size

Register 1802 provides the number of 16 bit data words in the IBS ring. This value does not include loopback or CRC words.

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Failed Terminal Number

Register 1803 provides the ordinal number of the bus terminal with a failed downstream remote or local bus. R[1798].7 or R[1798].8 will be set to indicate the type of failure. R[1803] will be zero if there is no error.

Layout Checksum

Register 1804 provides a checksum value for the Intended Layout of the IBSM PLUS. The returned value may be used to provide the PLC with a verification that the IBSM is properly configured.

Map Checksum

Register 1805 provides a checksum value for the Map of the IBSM PLUS. The returned value may be used to provide the PLC with a verification that the IBSM is properly configured.

Module Protection Password

The IBSM PLUS has simple password protection of the "Options Register" in register 1795. Register 1807 stores the password. If there is a password stored, reads of register 1807 return with the value -1; otherwise a value of 0 is returned. Access to the options register 1795 is prohibited when a password is stored. To remove the password protection write the stored password value to register 1806.

Most Recent CRC Error Number

Register 1808 provides the ordinal number of the bus terminal which most recently reported a CRC error. A value of 255 indicates that the IBSM itself reported the CRC error on the last hop.

Most Recent Module Error Number

Register 1809 provides the ordinal number of the bus terminal which most recently reported a Module error.

"Sticky" Module Status

Register 1810 provides a time extended version of register 1798. When bits 7, 8, 9, 11, 12, or 13 are set in register 1798, the entire register contents of 1798 are copied to register 1810. The value in register 1810 is held until 1 second after the last error bit is cleared. This register is used for applications where the PLC might miss a quick transition of an error bit.

Aditional Statistical Registers

Registers 8000 through 8005 provided additional statistical counters for troubleshooting systems.

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Table 3-10 Additional Statistical Counters

Register	Counter
8000	Loop Error Counter
8001	Maximum consecutive scans with loop errors
8002	Not Used
8003	Timeout Error Counter
8004	INTL (internal no-send Error Counter
8005	SLER Error Counter

MAP

Registers 2049 through 4548 constitute the Mapper. There are 500 five register entries available for use. The entries are composed of 5 consecutive registers in the following order:

- Map FROM register. Zero indicates the end of the map.
- Map TO register.
- Register Count.
- Bit mask. 1 to disable a bit.
- Rotate count. 0..15. Rotate each word left before masking.

The Mapper is capable of mapping any internal register to almost any other internal register. If the target register is in the rack addressable area, the Mapper will convert the register from a PLC output to a PLC input. It is reasonable to have multiple targets from the same source. Care must be exercised when mapping multiple sources to a single target. Multiple source mappings are best performed at the bit level using the rotation and masking features. Several suggested mapping are shown below.

- Map PLC outputs to IBS outputs.
- Map IBS inputs to PLC inputs.
- Map IBS inputs to IBS outputs.
- Map IBSM status registers to PLC inputs.
- Map PLC outputs to IBSM control registers.

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Register Range	Function
1..512	PLC Rack Addressable Area
513..768	InterBus-S INPUTS
769..1024	InterBus-S OUTPUTS
1025..1281	Intended InterBus-S Layout
1282..1538	Actual InterBus-S Layout
1539..1794	InterBus-S Module Errors
1795..1803	IBSM Configuration
1804..2048	Not Used, READ as 0
2049..4548	MAP
4549..8175	Not Used, READ as 0
8176..8192	IBSM SY/MAX ID

Table 3-11 Mapper

Register	Map Entry	Description
2049	1	Map FROM reg.
2050		Map TO register
2051		Register Count
2052		Bit Mask
2053		Rotate Count
2054	2	Map FROM reg.
2055		Map TO register
2056		Register Count
2057		Bit Mask
2058		Rotate Count
...	...	...
4548	500	Rotate Count

Communication Port Number

Register 8176 provides a mechanism for determining the port used to communicate with the IBSM. A value of 0 indicates the COMM port. A value of 1 indicates reading from a Slave port.

NR&D ASCII ID

Registers 8177 through 8186 provide the module identification and firmware revision in a packed ASCII format.

Register 8188 is always set to a constant hex value 9990.

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4

Configuration Software IBSMSW

The IBSMSW software program is provided free of charge to IBSM users. This software is used to help configure the operation of the IBSM.

Data Entry Keys

Whenever data entry is allowed by the program, certain keys can be used to facilitate data entry. They are:

BACKSPACE	Move cursor left and remove character there
LEFT ARROW	Move cursor to the left one character
RIGHT ARROW	Move cursor to the right one character
DEL	Remove the character under the cursor
INS	Change between insert and overstrike modes of entry
HOME	Move cursor to the left edge of the field
END	Move cursor to the end of the data
Control-F	Move cursor right (Forward) one word
Control-R	Move cursor left (Reverse) one word
Control-D	Delete from the cursor to the end of the field
Control-U	Delete from cursor to the beginning of the field
Control-Y	Delete all characters in the field
ESC	Exit the field without modifying it
ENTER	Accept the contents of the field

When a field is opened for input, the cursor is positioned at the left side of the field. If data is already present in the field, typing any character other than those listed above will cause the field to be blanked allowing entry of new data without first deleting the

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old. If it is desired to retain the previous data for editing, make sure the first key you type is an editing key such as a left or right arrow.

Main Menu

The startup screen of IBSMSW is shown in Figure 4-1. The operational modes are selected by the highlighted menu bar on the fourth line. Selection can be made by moving the cursor to the desired option using the arrow keys and pressing **ENTER**. A short cut is provided, simply type "**N**" for oNline, "**F**" for oFfline, "**U**" for Utility, "**S**" for setup or "**Q**" to quit.

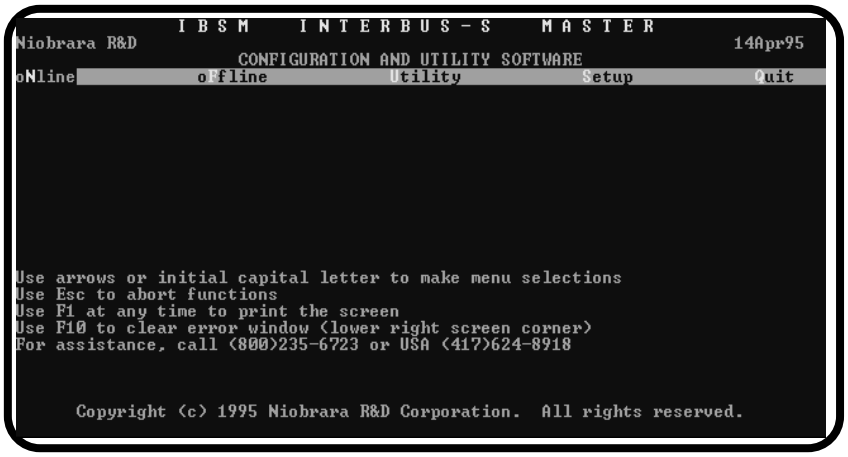


Figure 4-1 Main Menu Screen

oNline

The oNline selection provides a sub-menu for dynamically Editing the parameters or for Printing the parameters from the module.

Edit Configuration

Upon selection of Edit, IBSMSW attempts to connect to the IBSM using the Setup parameters defined in the Sy/Max Setup menu. For oNline Edit to function properly, all setup parameters must be correct for the equipment used including the baud rate, parity, checksum, and route. For more information on the Sy/Max Setup parameters see page 31.

Once IBSMSW has been able to connect to an IBSM, the screen should look something like Figure 4-3. The TX and RX lights over the RS-422 port will be flashing an the small line in the upper right corner of the screen should be spinning. While oNline, IBSMSW is continuously polling the IBSM and displaying the parameters on the screen. If any parameters are changed, the effect will be immediate and the modem will react according to the change. It is important to realize this, as changes made to parameters such as the mode, parity, baud rate, etc. may result in the loss of communication to the IBSM.

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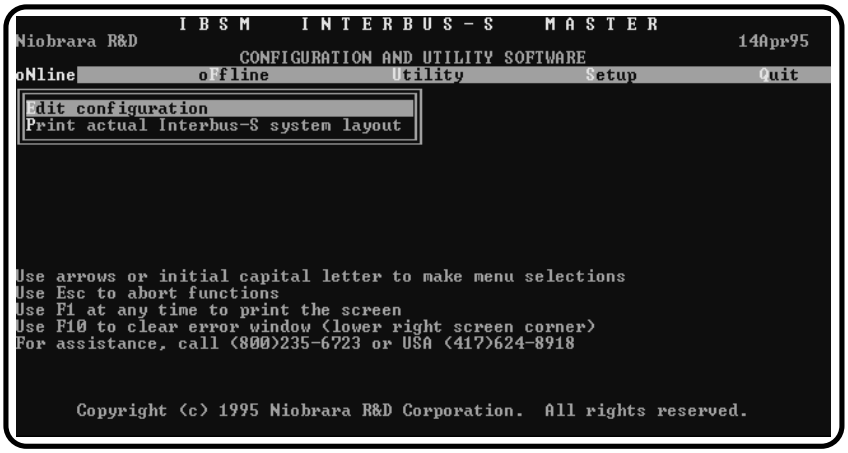


Figure 4-2 oNline Menu

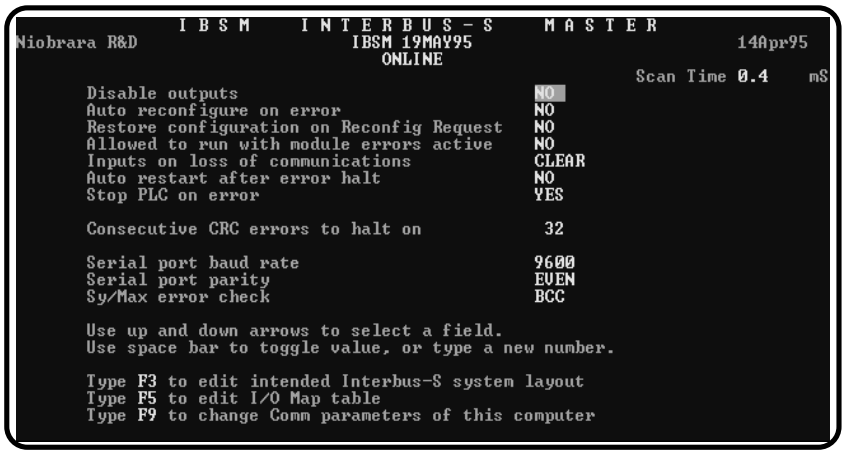


Figure 4-3 oNline Edit

The block cursor is moved about the screen using the arrow keys on the keyboard. Individual parameters may be modified by toggling through the permitted parameters using the -. +, and space bar. Parameters requiring direct value entry, such as the I/O Map table entries, may be edited with the commands listed on page 31. Several Function keys are active while in the online screens and are described below:

- F1 Print - The F1 Function key will allow a direct printing of the screen to a printer or ASCII file. A window will open in the middle of the screen prompting for the destination of the print. The target may be a DOS device may be such as "LPT1" etc. or to an ASCII text file by entering a filename. Pressing Escape will abort the print screen.
- F3 Layout - The F3 Function key provides access to the Intended Layout of the IBS.
- F5 Map - The F5 Function key provides access to the I/O Map table.
- F9 SY/MAX Setup - The F9 Function key will bring up the SY/MAX Setup window for immediate modification of the setup parameters of IBSMSW. Pressing Escape will exit from the Setup window without making changes.

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- F10 Clear Error - When any Error Window appears with a beep, the F10 key may be used to clear that error.

The opening screen of the oNline Edit provides a list of global parameters for the IBSM. Near the top of the center of the screen, the **firmware revision** of the IBSM is displayed. The **date** displayed in the upper right hand corner of the screen is the revision of the IBSMSW software. The word **ONLINE** displayed below the IBSM firmware date indicates that this is an online connection. The **Scan Time** of the IBS network is dynamically displayed in the upper right hand corner of the screen.

The **Disable outputs** item allows an immediate disabling of the outputs on the IBS. Setting this value to YES causes R[1795].1 to be set in the IBSM. Setting this value to NO causes this bit to be cleared. The default value is NO.

The **Auto reconfigure on error** item allows the IBSM to attempt reconfiguration (and set the appropriate downstream disable bits in the intended layout) when bus segments are missing or not responding. Setting this value to YES causes R[1795].2 to be set in the IBSM. Setting this value to NO causes this bit to be cleared. The default value is NO.

The **Restore configuration on Reconifig Request** item allows the IBSM to initiate reconfiguration (by clearing all downstream disable bits in the intended layout) when a reconfigure request is received from a bus terminal. Setting this value to YES causes R[1795].3 to be set in the IBSM. Setting this value to NO causes this bit to be cleared. The default value is NO.

The **Allowed to run with module errors active** item determines whether the IBS network continues to run when a module error is active. Setting this value to YES causes R[1795].4 to be set in the IBSM. Setting this value to NO causes this bit to be cleared. The default value is NO.

The **Inputs on loss of communications** item determines the state of the IBS input registers in the IBSM upon loss of communication on the IBS network. If set to CLEAR, registers 513..768 will be set to zero upon loss of communication on the IBS network. If set to FREEZE, the registers 513..768 will remain unchanged. Setting this value to FREEZE causes R[1795].5 to be set in the IBSM. Setting this value to CLEAR causes this bit to be cleared. The default value is CLEAR.

The **Auto restart after error halt** item determines whether the IBSM should attempt to recover after an IBS bus halt. If set to NO, IBSM R[1795].1 must be set and then cleared to restart an IBS bus halted by an error. If set to YES, the IBSM will automatically switch the bus from halt to run anytime it is possible to do so. Setting this value to NO causes R[1795].6 to be set in the IBSM. Setting this value to YES causes this bit to be cleared. The default value is YES.

The **Stop PLC on error** item determines whether the IBSM should generate a PLC bus error to stop the PLC after an IBS bus halt. If set to NO, the IBSM will not generate a bus fault when the IBS is halted. Setting this value to NO causes R[1795].7 to be set in the IBSM. Setting this value to YES causes this bit to be cleared. The default value is YES.

The **Consecutive CRC errors to halt on** item determines the number of consecutive IBS network errors required stop the IBS bus. The default value is 32.

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The Serial port baud rate determines the setting for the SY/MAX COMM port on the IBSM. Care should be taken in changing this value as its setting is immediately changed and a loss of communication from the personal computer may occur. The available settings are 50, 75, 110, 134.5, 150, 300 ,600, 1200, 1800, 2400, 4800, 7200, 9600, and 19200. The default setting is 9600.

The Serial port parity determines the setting for the SY/MAX COMM port on the IBSM. Care should be taken in changing this value as its setting is immediately changed and a loss of communication from the personal computer may occur. The available settings are EVEN and NONE. The default value is EVEN.

The Sy/Max error check determines the setting for the SY/MAX COMM port on the IBSM. Care should be taken in changing this value as its setting is immediately changed and a loss of communication from the personal computer may occur. The available settings are BCC and CRC. The default value is BCC.

Pressing the **F3** Function key while online allows the editing of the intended InterBus-S system layout. The screen should appear something like Figure 4-4.

The Entry column denotes the IBS module in the network. The ID column is the decimal value of the Module Identification and this value is usually located on the IBS module. Each IBS module will have an entry, even if it has a 0 width such as a BK-T bus terminal.

The Width column identifies the number of registers of data in the IBS module. Some devices will have a zero width, such as a BK-T bus terminal, other devices may have 1, 2, 4, or more registers of data. All IBS modules have the same number of input and output registers, regardless if they are used. A 16 bit digital input module, a 16 bit digital output module, and a module with 16 bits of input and 16 bits of output all have a width of 1.

The Description column provides a brief description of the IBS module based upon the ID and the Width values.

The Disable column allows individual modules to be disabled from the IBS layout. When a module is disabled, its inputs represented in the IBSM are set to zero and its outputs are also set to zero.

The **F6**, **F7**, and **F8** keys are used for copying, inserting, and removing lines from the list. The **F2** key may be pressed to load a copy of the actual IBS layout into the intended layout.

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Figure 4-4 Intended IBS System Layout Editor

Pressing F5 while in the oNline Edit screen will bring up the Edit Map Online screen. The Map provides a mechanism for copying data from any register in the IBSM to almost any other register in the IBSM. The Map consists of a FROM entry, a TO entry, a Word Count, a Mask, and a Left Rotate Count. (See Figure 4-5)

The From Register entry determines the IBSM register that the data will be copied from. The IBSMSW displays a label denoting the function of the register; such as (PLC OUT), (PLC IN), (IBS IN), (IBS OUT), and (Internal).

The To Register entry determines the IBSM target register for the copy. If the register is in the rack addressed area, the IBSM will force that register to be a PLC INPUT. Certain restrictions apply to the To Register value. Data copied to registers that are read only registers in the IBSM will be immediately overwritten. This applies to Internal registers as well as IBS Input registers.

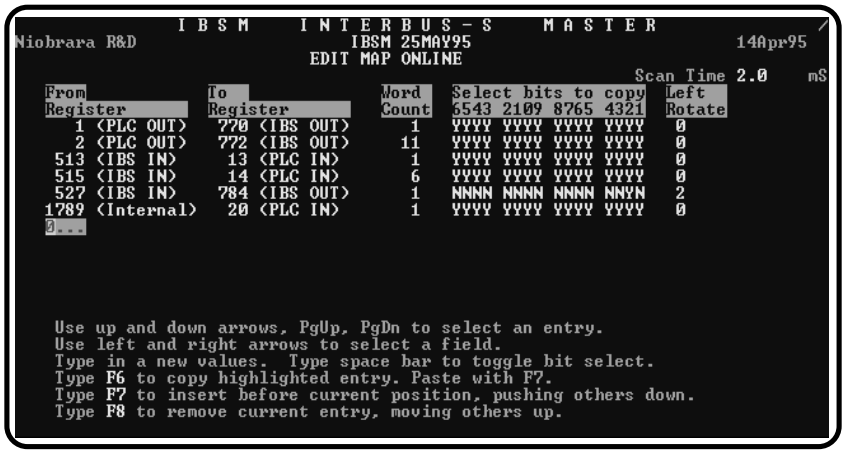


Figure 4-5 IBSM Mapper Editor

The Word Count entry determines the number of consecutive registers that will be copied. A word count of 1 copies only the From register to the To register. A word count of 3 will copy the the From, From+1, and From+2 registers to the To, To+1, and To+2 registers.

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The Select Bits to copy entries determine which bits will be copied to the To register. If a bit is selected with a "Y", then that bit will be copied to the target register. If a "N" is selected, that bit will not be copied to the target. The default setting is that all bits will be copied. The mask will be applied to all words in the word count. If a Left Rotate is selected for that entry, the rotate will occur before the mask is applied.

The Left Rotate setting determines the number of bit positions that that each word will be rotated before masking. A setting of 0 disables the bit rotation. A setting of 1 will move bits 1 to 2, 2 to 3, 3 to 4, ... 15 to 16, and 16 to 1. A setting of 8 will exchange the LSB with the MSB. The Left Rotate will be performed before the mask, if selected, is applied. If multiple words are selected in the Word Count, the Left Rotate is applied to each word as it is being copied.

Print Configuration

The Online Print Configuration feature allows a direct formatted printing of the parameters in the IBSM. A serial connection to the IBSM is required. Once selected, window is opened to prompt the user for the target of the printout. This target may be a printer or an ASCII file. After selection of the target, the IBSMSW polls the IBSM for its configuration parameters and sends them to the target device.

oFfline

The oFfline menu offers several choices for maintenance, storage, and retrieval of IBSM configurations. The oFfline menu is shown in Figure 4-6. The oFfline menu items perform their operations using a copy of IBSM setup parameters in the personal computer's memory. This copy may not be related to the actual configuration in an IBSM that may be connected oNline. Any changes made in the oFfline Editing that are needed to be transferred to a connected IBSM must be done with the Send memory to module menu item.

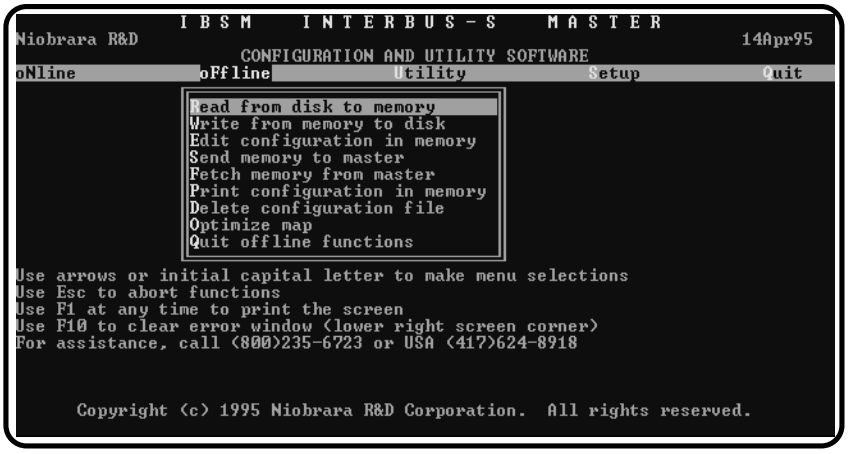


Figure 4-6 oFfline Menu

Read from disk to memory

This function reads an IBSM configuration from disk into the computer's memory. The file to be read should have been created by the "Write from memory to disk" function described below and must have a .IBS extension. When "Read from disk to memory" is selected, a window will open and ask for the name of the file to read. The bottom part of the screen will show a list of all files with the extension .IBS in the

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current directory. Any subdirectories, or drives, will be shown in square brackets. The parent directory (of which the current directory is a subdirectory) is shown by the word "parent" in square brackets. You may either type the name of the file to read or you may use the arrow keys to move the highlight to the desired filename. Pressing **ENTER** with the highlight on a filename will select that file for reading. Pressing **ENTER** with the highlight positioned on a directory name (either a subdirectory or [parent]) will change the current directory to that directory and will show the .IBS files in the new directory. If there are more files than will fit on the screen, pressing the right arrow with the highlight at the right edge of the screen will scroll the display sideways to show more files. Typing the **ESC** key will return to the offline function menu without loading a file.

Write from memory to disk

This function saves a copy of the memory file to a disk file. "Write from memory to disk" uses the same point and shoot file selection described for "Read from disk to memory" above. To create a new file you must type the name. The name should be a valid MS/DOS filename but should not include any path name or extension. The program will append an extension of .IBS to the name and the file will be placed in the directory which is shown in the bottom half of the screen. To create a file in a directory other than the current one, use the arrow and **ENTER** keys to traverse the directory tree until a listing of the desired directory is shown in the bottom half of the screen. Then type in the file name and press **ENTER**. If you specify (either by typing or by pointing) a file that already exists, you will be prompted for approval before that file is overwritten.

Edit configuration in memory

The Edit selection brings up a screen similar to the oNline Edit screen. Use the editor in the normal fashion to make changes to the memory file. Upon completion of the editing, it is advised that the work be saved using the "Write from memory to disk" routine. Upon exiting the editor, the main IBSMSW menu will appear.

It is important to remember to save the file before exiting or the changes will not be made.

Send memory to master

This function requires a physical connection from the computer to an IBSM. The SY/MAX setup must be properly configured to allow oNline communication to the IBSM. When the "Send memory to master" selection is made, the configuration in the computer's memory is immediately transferred to the IBSM.

Fetch memory from master

This function requires a physical connection from the computer to an IBSM. The SY/MAX setup must be properly configured to allow oNline communication to the IBSM. When the "Fetch memory from master" selection is made, the configuration in the IBSM is immediately transferred to the oFfline memory.

Print configuration in memory

This function will produce a report showing the current oFfline configuration parameters in the computer's memory. When this function is selected, the user will be

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prompted for an output filename with the default value of PRN shown. To send the report to the PRN device (normally the parallel printer port), simply press **ENTER**. To send the report to a different port or to a file, type the name and then press **ENTER**. Online configurations may be printed with the **F1** print screen key.

Delete configuration file

This function removes the selected IBSM source file from the disk. "Delete configuration file" uses the same point and shoot file selection described for "Read source from disk" above. The name should be a valid MS/DOS filename but should not include any path name or extension. The program remove the file from the disk as well as removing it from the bottom of the screen. To remove a file in a directory other than the current one, use the arrow and **ENTER** keys to traverse the directory tree until a listing of the desired directory is shown in the bottom half of the screen. Then type in the file name and press **ENTER**.

Optimize map

This function inspects the map in memory and minimizes the number of entries in the mapper for the most efficient IBS scan time possible. For example, if the map contained two entries like the following:

FROM = 517 TO = 8 COUNT = 2
FROM = 519 TO = 10 COUNT = 1

The optimizer would change the map to one entry:

FROM = 517 TO = 8 COUNT = 3

Quit offline functions

Selecting this menu item will return the user to the main menu. Pressing the Escape key will perform the same function.

Utility

The Utility menu provides access to useful maintenance and testing functions of the IBSMSW software.

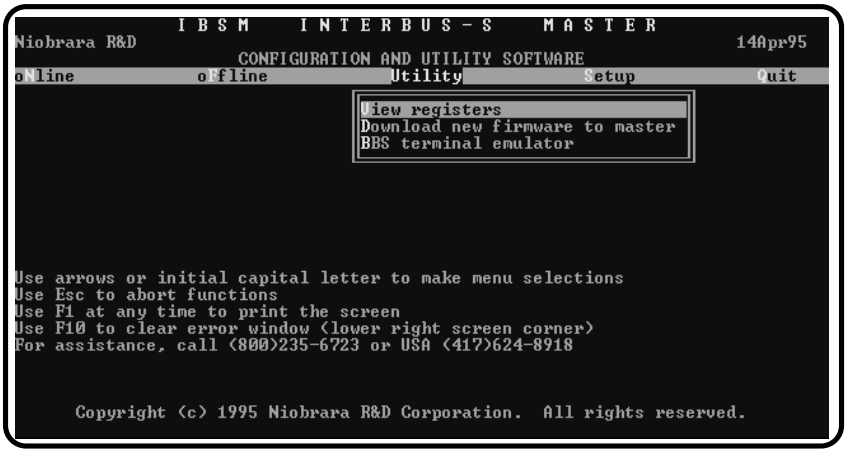


Figure 4-7 Utility Menu

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View registers

Selecting the View registers menu item will invoke a SY/MAX register data viewer/modifier. This viewer continuously performs a block read of 20 registers and displays the contents of those registers in hex, unsigned integer, signed integer, and binary. The status register associated with the data register is also displayed in hex. The register viewer is dependent on the values located in the SETUP Sy/Max menu. Mode, Baud rate, Parity, Route, etc. must be properly set for proper communication.

The Up and Down arrow keys are used to move from register to register.

The Page Up and Page Down keys move in increments of 10 registers.

The Left and Right arrows move from column to column on the same register.

This register viewer is highly useful in that it allows easy editing of the data in the register being viewed. By pressing 0..9 in the decimal fields or 0..9, or A..F in the hex field, an editing mode is entered. New data may be entered at this time. Pressing the Enter key or moving to a new field with the arrow keys will cause the new data to be written to the edited register. If the curser is located in the REGISTER column the block of registers being viewed may be adjusted by entering a new register number. To edit the binary values, press HOME when on the binary field. Move the cursor to the desired bit and enter a ’0’ or a ’1’ and press enter to accept.

Pressing the F9 key will invoke the SY/MAX Setup window for immediate access to the personal computer’s communication parameters.

Pressing Esc will exit from the Register viewer and return to the main menu. Pressing Esc while editing a data field will result in canceling the edit and the modified data will not be written to the register.

The STAT field displays the status register associated with the data register. The STATUS field is a read only display and can not be modified by the Register Viewer. Two common values are E000 and A000. A000 is the hex representation that the PLC recognizes as a PLC OUTPUT register. E000 is for a PLC INPUT register. This allows easy recognition of registers used by the IBSM as inputs and used by the PLC as outputs.

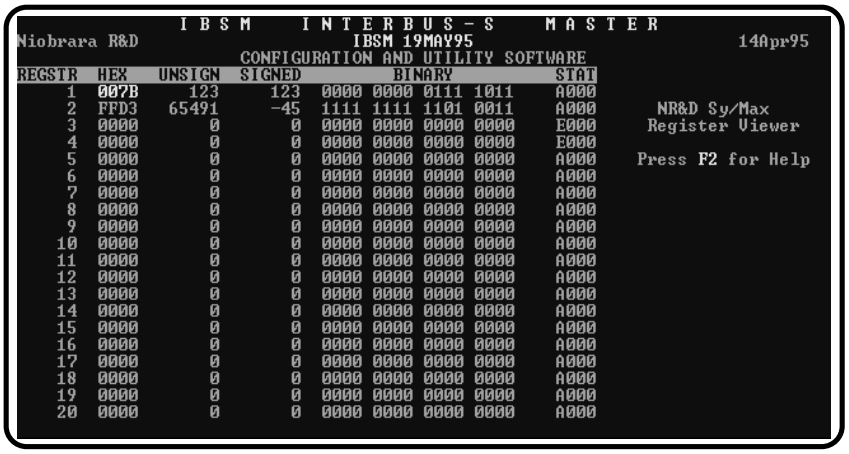


Figure 4-8 View Registers

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Download New Firmware to IBSM

The Download new firmware to IBSM utility allows the field installation of upgrades provided by Niobrara via the RS-422 serial port. To load new firmware into the IBSM, perform the following steps:

1 Remove power from the register rack.

2 Remove the IBSM from the register rack.

3 Locate the Load/Normal toggle switch on the back of the IBSM. (See Figure 4-9) Move this switch to the LOAD position.

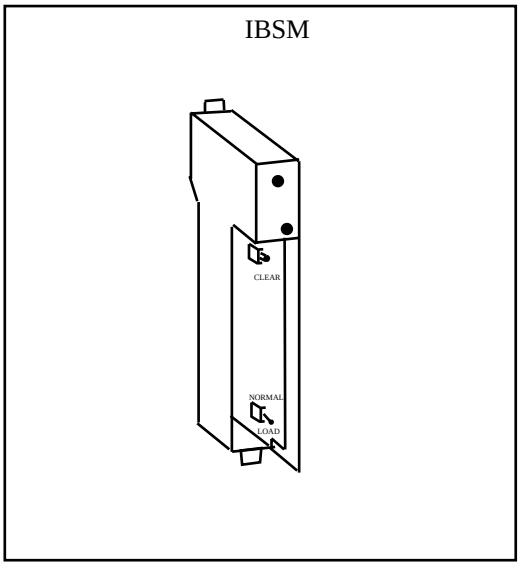


Figure 4-9 IBSM Firmware Load Switch

4 Install the IBSM back into the register rack.

5 Apply power to the rack. The IBSM should perform its startup sequence and display the messages TEST, ROM1, RAM1, LOAD. If the display does not show LOAD, remove power and check the setting of the LOAD/NORMAL switch.

6 Connect the personal computer to the COMM port of the IBSM. An SC902 cable provides a convenient method for the RS-232<>RS-422 conversion. (See Figure 4-10)

NOTE: It is important to directly connect the IBSM to the personal computer. The Firmware Download utility uses the same personal computer COM port as the normal SY/MAX settings, but the baud rate, parity, and protocol is different. The Firmware Download uses 19200 baud, NONE parity and a custom protocol that is not SY/MAX compatible. It is not possible to download new firmware over normal SY/NET networks.

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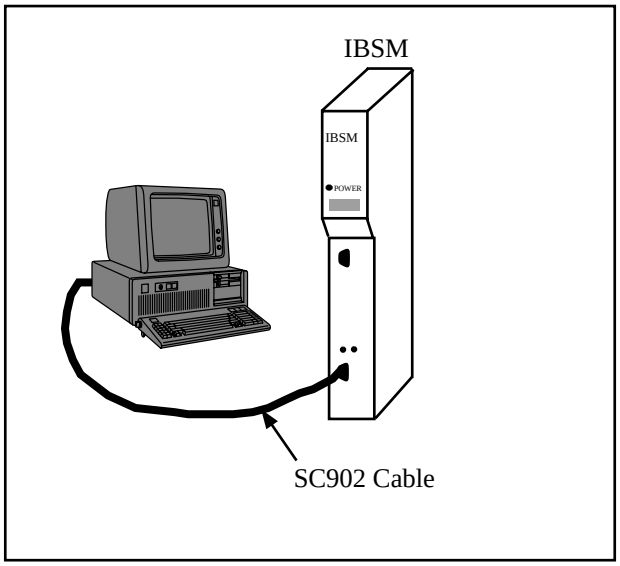


Figure 4-10 IBSM Firmware Download

7 From IBSMSW's main menu, select Utility, Download New Firmware to IBSM. A window prompting for the file to download will appear. Select the IBSM for a standard IBSM or IBSM2 for an IBSM PLUS and press Enter. (See Figure 4-11)

8 Wait for the firmware download to be completed. A message indicating completion will be displayed on the personal computer.

9 After the completion of the download, remove power from the register rack.

10 Remove the IBSM from the rack.

11 Change the LOAD/NORMAL switch back to NORMAL.

12 Install the IBSM back into the register rack.

13 Connect power back to the register rack. The IBSM should go back through its startup checks and display OPEN, SLER, HALT, RUN, DSBL, or whatever it displayed before the new firmware was downloaded.

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Figure 4-11 Download Firmware

BBS Terminal Emulator

Selecting the BBS Terminal emulator from the Utilities menu will invoke a terminal emulator according to the setup selected in the Setup menu. The terminal emulator opens as shown in Figure 4-12.

The terminal sends the ASCII code for the alpha-numeric characters out the selected COM port. Functions keys F1 through F4 and the keypad arrows send ANSI (i.e. VT100) codes. F7 is reserved for starting a file capture. F8 will close the capture file. The backspace key sends ASCII BS (08 hex). The Delete key sends and ASCII DEL (7F hex). The Insert key allows the transmission of ASCII hexadecimal characters directly from the hex numbers separated by spaces.

The F9 key will invoke the Terminal Emulator Setup Screen for immediate modification of the personal computer's communication setup parameters.

The BBS terminal displays printable ANSI ASCII characters which are received on the port.

X/YMODEM transfers are supported within the BBS Terminal Emulator for ease of file transfers with the NR&D ONLINE BBS. At the point of transferring the file, press the PAGE UP key to have the personal computer send the file to the BBS or press the PAGE DOWN key to have the personal computer receive the file from the BBS.

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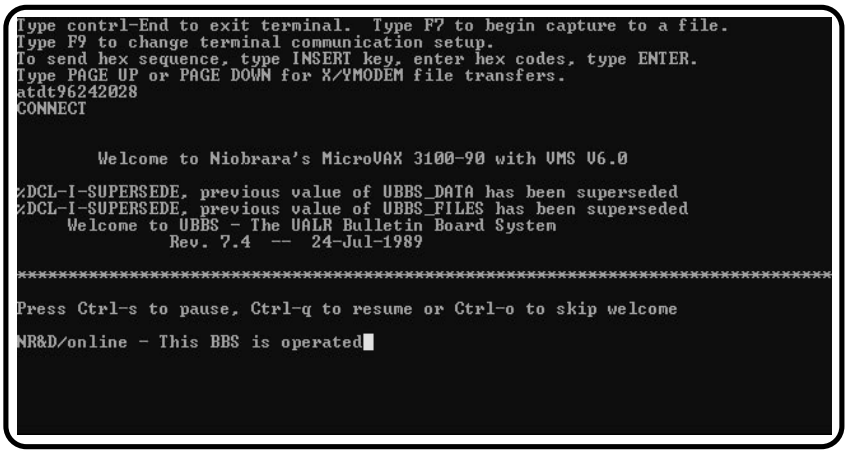


Figure 4-12 Terminal Emulator

SETUP

The setup menu accesses the setup parameters for the personal computer to enable it to communicate with the IBSM and the terminal emulator. The parameters chosen will depend on the exact equipment involved in making the connections. The Setup menu should appear as in Figure 4-13.

SY/MAX SETUP

The connection type is mainly determined by the method of connection to outside world and may be broken into two groups: the personal computer's COM: port and the SY/LINK Network Interface Card.

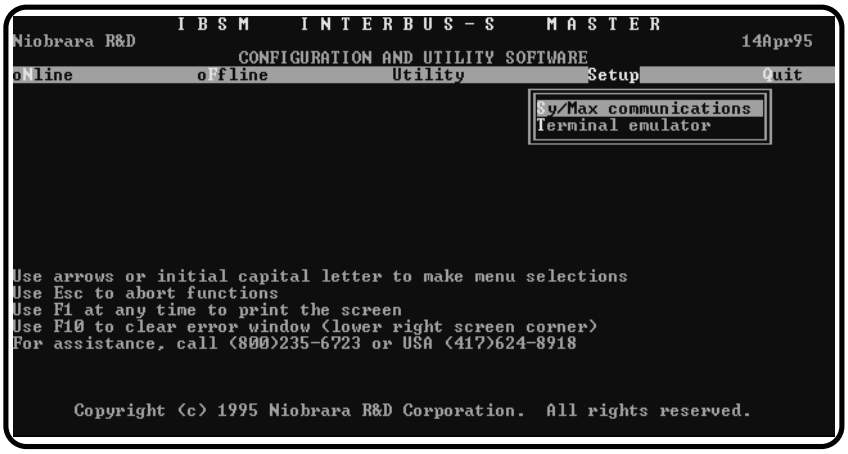


Figure 4-13 Setup Menu

Personal Computer COM: port

If the connection from the personal computer is made through one of its serial ports then the Connection type should be one of the following:

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- Sy/Max COM:
- Net-to-Net COM:
- Gateway COM:

Sy/Max COM: is the default and most likely will be the one used. In this mode the personal computer will communicate through one of its COM: ports as though it were a SY/MAX device such as a PLC. The full SY/MAX protocol is supported including routing so SY/MAX COM: may be used through SY/MAX mode ports on NIMs and SPE4s with appropriate routing. This mode is to be used when a direct connection from the personal computer COM: port is made to the IBSM. In most cases an RS-232<>RS-422 conversion is required and the Niobrara SC406 (or SC902) cable makes this conversion very convenient.

Net-to-Net COM: is used when connecting to a NIM or SPE4 that is set to Net-to-Net mode. The first drop number in the route will be that of the address of the NIM.

Gateway COM: is used when connecting to an SPE4 port that is in Gateway mode. For more information about Gateway mode see the SPE4 instruction manual.



Figure 4-14 SY/MAX Setup Screen

Port - When one of the COM: connection types is selected a particular port of the personal computer must be selected. Available choices are: COM1:, COM2:, COM3:, and COM4:. Select the port which will be used to connect to the IBSM.

Baud rate - The Baud rate selected here is the baud rate of the personal computer serial port selected. This value should be set to match the device connected to the personal computer. An IBSM has a default baud rate of 9600 and if a direct connection is made to the IBSM this is the setting that should be made on the personal computer. If the baud rate of the IBSM has been changed this value may need to be adjusted.

Data bits - When in SY/MAX or Net-to-Net modes the data bits is required to be 8 and may not be changed. The SY/MAX protocol requires 8 data bits. The Gateway

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mode uses ASCII messages which do not require the full 8 data bits and may be set to 8 or 7 depending on the attached device.

Stop bits - The stop bits are normally set to 1 but may be adjusted to 2 for some particular application. The IBSM is set for 1 stop bit.

Parity - SY/MAX and Net-to-Net modes normally use EVEN parity and that is the default for the IBSM. Other choices are ODD and NONE.

Route - The route is used to determine the path from the personal computer to the IBSM. If a direct connection is made from the personal computer to the IBSM, i.e. without going through a SY/NET network or an SPE4, this value is set to NONE by pressing the Delete key. If a SY/MAX connection is made to a SY/MAX mode port on an NIM or SPE4 the first drop will be that of the drop number of the NIM or SPE4 port. If any Net-to-Net drops are included between the port connected to the personal computer and the port connected to the IBSM, they must be included in order of occurrence from the personal computer to the IBSM. The last drop number listed will be that of the NIM or SPE4 SY/MAX mode port that is connected to the IBSM. Up to 8 total drops are supported by the SY/MAX protocol.

If the personal computer is in Net-to-Net mode the first drop will be that of the Net-to-Net port of the NIM or SPE4 that the personal computer is connected to. Subsequent drops will be included like above.

The Gateway mode route will include the Gateway port on the SPE4 that the personal computer is connected and any subsequent Net-to-Net and SY/MAX drops to reach the IBSM.

SY/LINK Connection

IBSMSW provides full support of the Square D SY/LINK network interface card. Setup for the network interface is provided along with setup for the RS-422 port on the card.

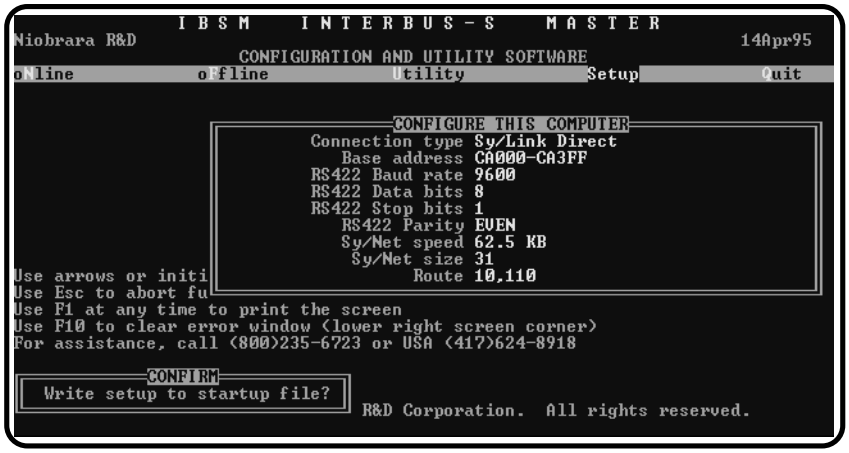


Figure 4-15 SY/LINK Setup Screen

Connection type - The RS-422 port may be set to SY/MAX or Net-to-Net modes. For a direct connection to the AIM4 from the RS-422 port of the SY/LINK card choose the Sy/Link Direct mode. If an indirect connection from the RS-422 port of the card is made through other Net-to-Net ports choose Sy/Link Net-to-Net. If the

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RS-422 port is not used and the connection is make through the SY/NET network to another NIM, the choice does not matter.

Base address - This is a hex value that represents the SY/LINK's cards address range selected by DIP switches on the card. Select the same range that is set on the card.

RS422 Baud rate - Select the baud rate to match the external device, normally 9600.

RS422 Data bits - Select the data bits to match the external device, normally 8.

RS422 Stop bits - Select the stop bits to match the external device, normally 1.

RS422 Parity - Select the parity to match the external device, normally EVEN.

Sy/Net speed - Select to match the speed settings of the other devices on the SY/NET.

Sy/Net size - Select to match the setting on the other SY/NET devices.

Route - The first drop in the route defines the network address of the SY/LINK board. Since the personal computer is connected to the SY/LINK card through the edge connector of the card, port 0, the drop number must start with 0. The remaining two digits of that drop should be selected not to match any other device on the SY/NET. For instance, there are three NIMs on the network addressed 01, 02, and 03. It seems logical to make the SY/LINK card be at address 04 so the first drop in the route field will be 004. The next drop will be that of the NIM port connected to the IBSM, or another Net-to-Net port. If Sy/Link Direct was selected and the IBSM is connected directly to the RS-422 port of the SY/LINK card the full route statement would be 004, 104 as the RS-422 port is considered to be port 1.

Terminal Emulator SETUP

The Terminal Emulator setup allows an individual setup for the operation of the terminal emulator. For instance, this separate setup will allow COM1 to be used for the IBSM SY/MAX connection and COM2 to be used for a terminal emulator connection.

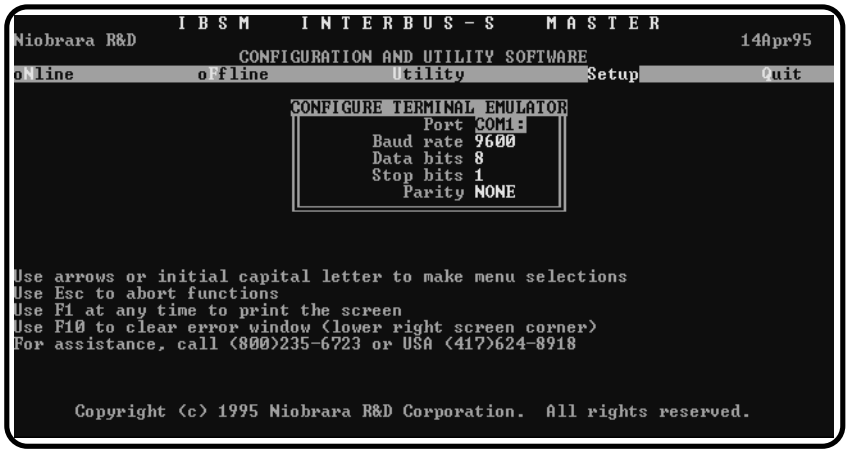


Figure 4-16 Terminal Emulator Setup Screen

Port - Available choices are: COM1:, COM2:, COM3:, and COM4:. Select the port which will be used to connect to the external device.

Baud rate - The Baud rate selected here is the baud rate of the personal computer serial port selected. This value should be set to match the device connected to the personal computer.

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Data bits - Selects the number of data bits for the message packet. Choices are 8 or 7 depending on the attached device.

Stop bits - The stop bits are normally set to 1 but may be adjusted to 2 for some particular application.

Parity - Choices are EVEN, ODD, and NONE.

Command Line Parameters

IBSMSW may be started from the DOS command line with a sequence of letters which represent the keystrokes necessary to perform any operation. This allows batch processing of various commands such as downloading of stored setup files. The special characters /R, /D, and /E refer to the Return key, Delete key, and Escape key respectively. The parameters are not case sensitive. The following example causes the IBSMSW software to Read a file named SAMPLE, and send it to the IBSM and then quits. It is assumed that the IBSM is connected to the computer and the rest of IBSMSW setup is correct.

>IBSMSW FRsample/RFSQ

Another way of changing the Setup is to copy the setup file to another name in DOS, then copy it back to IBSM.STP in the batch file before calling IBSMSW.

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5

Connector Pinouts

COMM RS-422 port on IBSM (DE9S with slide lock posts)

1 TX- transmit data (inverted) from IBSM to output device

2 TX+ transmit data (noninverted) from IBSM to output device

3 RX- receive data (inverted) from data source to IBSM

4 RX+ receive data (noninverted) from data source to IBSM

5 +5VDC for smart cable power

6 +5VDC for smart cable power

7 GND

8 GND

9 Shield ground. AC coupled to the chassis.

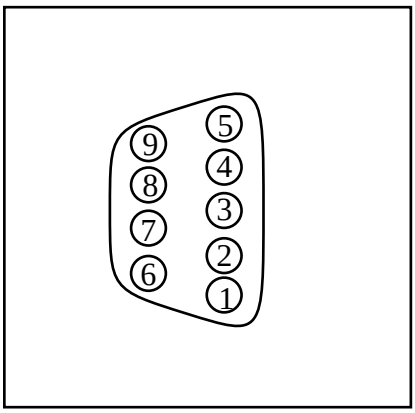


Figure 5-1 SY/MAX RS-422 Connector Pinout

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InterBus-S port on IBSM (DE9S with 4-40 jack sockets)

1 DO+ transmit data (noninverted) from IBSM to Remote device

2 DI+ receive data (noninverted) from Remote device to IBSM

3 COM isolated from the SY/MAX gnd.

4 No Connection

5 No Connection

6 DO- transmit data (inverted) from IBSM to Remote device

7 DI- receive data (inverted) from Remote device to IBSM

8 No Connection

9 Shield ground. AC coupled to the chassis.

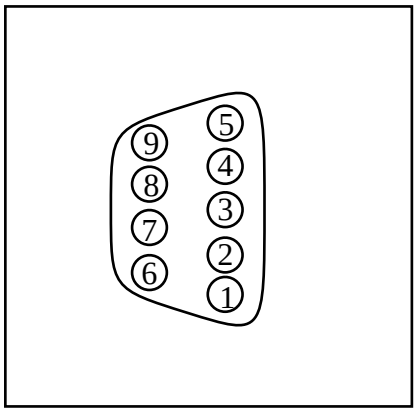


Figure 5-2 InterBus-S Connector Pinout

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6
Recommended Cabling

SY/MAX Cabling required to configure an IBSM

Configuration register data may be downloaded from an MS-DOS personal computer into the IBSM. The factory default configuration for the module in SY/MAX mode is 9600 baud, 8 data bits, EVEN parity, 1 stop bit and BCC checksum. The correct cabling needs to be installed to connect the personal computer to an IBSM port.

IBSM to personal computer cabling

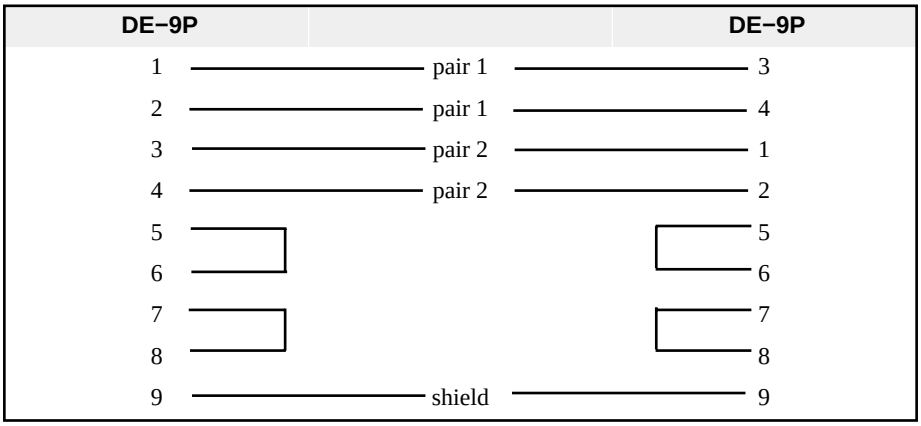
Connecting the RS-422 IBSM is very easy using Niobrara's **SC406 (or SC902)** RS-232 to RS-422 converter cable. If the personal computer has a 25-pin RS-232 port then no adapters are needed. If the personal computer has a 9-pin RS-232 port then a Niobrara **SD034** 25-pin to 9-pin adapter is needed for the SC406. The **SC902** cable will plug directly into the 9-pin port of the personal computer so no adapter is needed.

Note: The included power supply with the SC406 **(or SC902)** is not required when connecting to the IBSM. Pins 5 and 6 of the IBSM's RS-422 port provide the +5VDC to power the smart cable. Pins 7 and 8 provide the GND return for the cable.

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Cabling required to connect a IBSM port to an external device

IBSM RS-422 to SY/MAX RS-422 port



This is a Niobrara **DC1** cable.

InterBus-S Remote Network Cabling

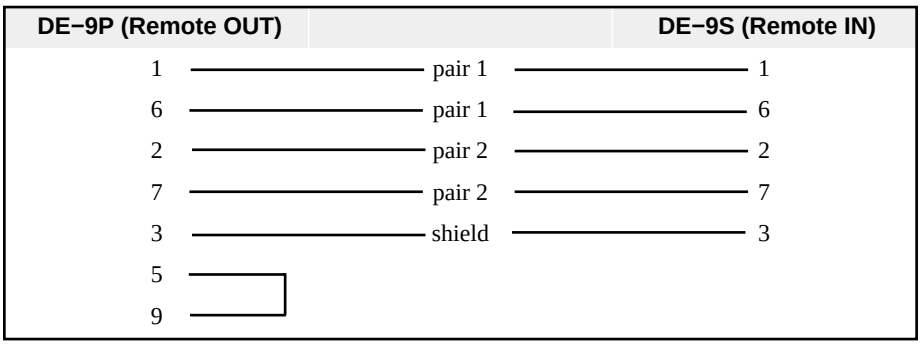


Figure 6-1 InterBus-S Remote Cable

This is a Niobrara IR9D cable.

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Appendix A
IBSM Display Messages

In the following definitions, nnn is a three digit decimal number specifying the module (remote or local bus) that is having difficulty. To determine nnn, count the first bus terminal, then its local bus modules from the bus terminal to the end of the local bus, then the next bus terminal, etcetera.

Cnnn - nnn is a three digit decimal number specifying the module (remote or local bus) which is reporting a CRC error. Modules are counted as described above. Look for bad cabling to or from the specified module, or a defective module.

CFIG - The actual system layout determined by the IBSM does not match the intended layout loaded by the user. One or more cables may be unplugged. Sometimes an Rnnn error will be displayed as CFIG because a cut cable shorts or capacitively couples the signal back along the cable.

CODE - The IBSM has detected a problem with its internal software.

CRCn - A module-to-module CRC error was detected as described under Cnnn above but the IBSM is unable to identify the offending module.

CRCM - A CRC error is being detected between the first remote bus module or bus terminal and the IBSM. Output data may be valid but input data is zeroed.

DSBL - The PLC CPU is instructing the IBSM to hold physical outputs at zero, but retain the logical state. The IBSM is scanning the bus and outputting zeroes to all modules. Registers 769 through 1024 reflect the logical state of all outputs.

Ennn - nnn is a three digit decimal number specifying the module (remote or local bus) which is reporting an error. The IBSM is unable to identify the specific error. Look for bad cabling to or from the specified module, or a defective module.

ERAM - The IBSM has detected a RAM problem and is defective.

EROM - The IBSM has detected a ROM problem. The master may be defective or the field-reloadable firmware may be corrupt.

ER02 - The IBSM has detected a problem with the boot firmware and the master is

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defective.

ER03 - The IBSM has detected a RAM memory error. The master is defective.

ER04 - The field-reloadable firmware is corrupted.

ERRn - A module is reporting an error is detected as described under Ennn above but the IBSM is unable to identify the offending module or the specific error condition.

Hnnn - nnn is a three digit decimal number specifying the module (remote or local bus) which mismatches the IBSM's intended network layout configuration. The error H001 is displayed when an unconfigured IBSM is connected to a functional Interbus-S network.

HALT - The PLC CPU is instructing the IBSM to set its outputs to zeroes. The IBSM is scanning the bus and outputting zeroes to all modules. Registers 769 through 1024 are zeroed.

IBSM - The IBSM is executing normal startup procedures.

INTL - The IBSM detected an internal error and may be defective.

Lnnn - nnn is a three digit decimal number specifying the bus terminal whose local bus the IBSM was unable to successfully connect. Look for a bad cable or defective module in the local bus attached to that bus terminal or a defective bus terminal. The IBSM is not scanning and will attempt to restart the bus once per second. If not disabled by 1795.7, the IBSM will signal the PLC CPU to halt with an I/O or bus error.

LOAD - The LOAD/NORMAL switch is in the LOAD position and the IBSM is prepared to accept new firmware via the RS422 serial port.

LOOP - The loopback word received by the IBSM did not match the one sent.

LONG - The physical Interbus-S ring is longer than the 4096 bit limit. This error may also indicate a cable break with long cables.

Mnnn - nnn is a three digit decimal number specifying the module (remote or local bus) which is reporting a module error. Module nnn is probably without power, has a blown fuse, a shorted output, or is defective. The meaning of a module error is dependent on the module type. Consult the module's documentation. The will continue to scan the bus but, unless 1795.4 is set, outputs will be set to zero and, unless disabled by 1795.7, the PLC CPU will halt.

MODn - A module error is detected as described under Mnnn above but the IBSM is unable to identify the offending module.

OPEN - A cable is open between the IBSM and the first remote bus terminal. The first bus terminal is defective, has an open fuse, or is not powered. The IBSM is not scanning and will attempt to restart the bus once per second. If not disabled by 1795.7, the IBSM will signal the PLC CPU to halt with an I/O or bus error.

PASS - The boot firmware has passed all self-tests and is about to start the master.

Rnnn - nnn is a three digit decimal number specifying the last remote bus module or bus terminal with which the IBSM is able to communicate. Look for a cable problem between remote bus module nnn and nnn+1, no power or an open fuse in module nnn+1, or a problem with one of those two modules. The IBSM is

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not scanning and will attempt to restart the bus once per second. If not disabled by 1795.7, the IBSM will signal the PLC CPU to halt with an I/O or bus error.

ROM1 - The IBSM boot firmware is testing the boot ROM.

ROM2 - The IBSM boot firmware is testing the field reloadable firmware at start-up.

ROM3 - The IBSM boot firmware is testing the field reloadable firmware after a reload.

RUN - The IBSM and the PLC CPU are running. Data is valid.

SLER - The SL test failed indicating a problem in the cabling,

TEST - The IBSM boot firmware is executing a self-test. If this message appears at any time except startup, check power supply voltages.

TOUT - The IBSM timed out waiting to receive data from the remote bus.

UDIS - Interbus-S outputs have been disabled by setting bit 1795.1 The mapper continues to scan and output image registers 769 through 1024 continue to reflect the map solution. The IBSM is scanning the ring and transferring zeroes (instead of the map solution) to all outputs.

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Appendix B
NR&D Internet

Niobrara Research & Development is on the World Wide Web making it easy to bring the user up to date on software revisions, firmware changes, product support news, and more. This Web service operates on a 24 hour a day basis and is accessible from any personal computer equipped with an Internet conection. The address is:

www.niobrara.com

E-mail communication is also provided for technical support and marketing questions.

techsupport@niobrara.com

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