Static Controls Corp.

PC-104 Ethernet Interface
Setup Guide

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1.0 Overview & Scope

This document presents the procedures and commands required to configure the PC-104 Ethernet module used with the NAB-x series CPUs. Please refer to www.Lantronix.com for documentation of all Lantronix® Ethernet adapters.

1.1 Revision History

This current document supersedes all earlier versions as noted below:

Rev	Date	Status
A0	04/08/04	Initial Release

1.2 Related Documents

Static Controls Corp., *Enhanced SCC Multi-Use Protocol* Version 2.00 Rev. A9 or later.
Static Controls Corp., *Troubleshooting Guide*

2.0 General Command Structure

This section provides an overview of the SCC Multi-Use Protocol command packet structure. Please refer to the SCC *Enhanced Multi-Use Protocol Version 2.00* for full details. This and other documents can be downloaded from www.SccControls.com.

2.1 Conventions

The following conventions are used throughout this document:

$XX   A pair of hexadecimal digits (0-9, A-F) preceded by a '$' indicates a hexadecimal byte value. Values from $00 to $FF are allowed.

x   Lower case 'x' indicates a user supplied ASCII HEX byte. ASCII HEX bytes are limited to range of ASCII codes for the characters 0-9 ($30-$39) and A-F ($41 to $46).

'X'   A character surrounded by single quotes indicates an ASCII printable character byte (codes $20 to $7F). For example, 'G' means $47 (i.e. the ASCII code for the letter G).

STX   A two or three letter character string indicates the mnemonic for an ASCII control code byte ($00 to $1F). For example, STX is Start of TeXt, which is a $02 in hex.

The protocol uses only ASCII codes (i.e. binary codes are never used).

The Enhanced SCC Multi-Use Protocol is a master-to-slave protocol. The master (host CPU) initiates all communications to the slave (display).

All Enhanced SCC Multi-Use Protocol version 2.00 commands use one of the following two general command structures:

[STX] [GROUP ADDRESS]   [UNIT ADDRESS] [DATA] [ENQ] [EOT]
                                       --or--
[STX] [GROUP ADDRESS]   [UNIT ADDRESS] [DATA] [ENQ] [ETX] [CHECKSUM]

Command packets are restricted to a maximum length of 255 bytes.

2.2 Command Packet: Initiation Field (STX)

The ASCII start of text character (STX = $02) is the first byte of all command packets. The STX is used to indicate the start of a packet. It is only used at the beginning of a packet and will never appear anywhere else in a packet. All slaves will assume that a new command packet is starting whenever this character is received.

2.3 Command Packet: GROUP and UNIT Address Fields

Immediately following the STX character is the GROUP address field. This is a two byte field where each byte is an ASCII HEX character. Therefore GROUP addresses from 00 to FF ($30 $30 to $46 $46) can be represented.

Following the GROUP address field is the UNIT address field. This is also a two byte field where each byte is an ASCII HEX character. Therefore UNIT addresses from 00 to FF ($30 $30 to $46 $46) can be represented.

Address "00" is reserved for use as a broadcast address. This address will automatically match that of all slave devices independent of the address set for the slave devices at setup. Both the GROUP and UNIT address fields support this broadcast feature. Therefore, a GROUP and UNIT address of "0000" will ensure that the command packet which follows will be received by ALL elements of ALL display boards on the network, regardless of their specifically set group and unit addresses. Although all display elements and display boards receive the command packet, only those devices which recognize the command as a valid command will respond.

2.4 Command Packet: DATA Field

The STX, GROUP and UNIT address fields are followed by the DATA field. This field is a collection of (optional) command codes and display data that control the hardware which was selected by the GROUP and UNIT address.

In general, the (optional) command portion of the DATA field takes one of two forms. Either the commands are single byte ASCII control codes ($00 thru $1F, but excluding STX, EOT, ETX and NAK), or they are multiple byte "escape sequences" where the ASCII control code, "ESC", is followed by one or more additional ASCII characters. These additional bytes for escape sequences are limited to the ASCII printable characters ($20 to $7F).

Following the DATA field are either characters to be displayed or, if an attribute is associated with the command, one or more ASCII HEX codes (0-F).

For alpha-numeric displays, the command is optional and ASCII characters to be displayed can be immediately sent. In such a case, they will begin displaying at the current cursor position.

Multiple commands can be sent per command packet. That is, once a slave device has decoded the STX-GROUP-UNIT address header sequence which matches its address, then all additional DATA field sequences will be received by that same slave until an EOT or ETX character is received.

2.5 Command Packet: Request Slave Response Field (ENQ)

This field is optional. If the ASCII control code ENQ follows the DATA field, then the slave will send a response back to the host following the termination of the current command.

The minimum response is either an ACK or a NAK ASCII control byte. However, much longer packets are produced in response to some commands.

The responsibility for controlling the slaves in order to prevent data bus collisions rests with the master (host) computer. Collisions are only a potential problem for multi-drop RS-485 configurations (i.e. two or more slave displays per RS-485 network).

2.6 Command Packet: Termination Field(s) (EOT or ETX-CHECKSUM)

The command packet can be terminated in one of two ways.

The first way is to terminate the command packet with an EOT character which will cause the slave to immediately execute the command.

Alternatively, an ETX character can be sent followed by a two byte ASCII encoded HEX checksum. In this case, the slave will first calculate a checksum of the received command packet and compare the calculated checksum value to the received checksum value. If they are equal, it will then execute the command; otherwise, it will ignore the command. If the DATA field included the ENQ command, then the slave will send a NAK character to indicate an invalid checksum.

The checksum is calculated by summing all of the bytes of the command packet starting with the GROUP address field, through and including the ETX byte. The sum is then truncated to its least significant byte and a two's complement of the remaining byte is performed. The resultant byte is then sent by the master as a pair of ASCII encoded hex digits.

3.0 Determining Current Configuration

To change IP settings, it is necessary to know both the current IP address and the serial number of the NAB-x CPU. This section describes various means of determining that information.

3.1 Default IP Settings

Where possible SCC will configure units with customer supplied IP settings. If customer IP preferences are unavailable the following default setting will be used.

IP: 192.0.1.230
Subnet Mask: 255.255.255.0
Gateway: No default gateway

3.2 Boot Time Information

At boot time, the alpha-numeric marquee (if present) displays a variety of informational messages including, but not limited to the following:

- Current NAB-x CPU software version.
- Serial number of the NAB-x CPU.
- Current GROUP and UNIT settings.
- Current IP Address.

3.3 Redisplay Boot Time Information

The boot time information can be redisplayed at any time using the SVN command. Note that the SVN command is available on select series of CPUs only.

The command syntax is:

> ESC 'SVN'

Where:
> ESC is the ASCII escape control code;
>
> 'SVN' is the character string 'SVN' (stands for System Version Number);

3.4 Console Redirect

The current IP settings and serial number of the NAB-x CPU can also be determined using the console redirect feature.

3.4.1 Displayed Information

At boot time, the NAB-x CPU displays a variety of information through the console redirect port. Information includes, but is not limited to the following:

- Current NAB-x CPU software version.
- Current Serial number of the NAB-x CPU.
- Current GROUP and UNIT settings.
- Current IP Address.
- Current Subnet Mask (if specified)
- Current Gateway (if specified)

3.4.2 Required Equipment

To view console redirect messages the following are required:

- Terminal Emulator Program (such as HyperTerminal).
- Open RS-232 serial port on host computer.
- RS-232 Console Redirect Cable (SCC Part# AD-0970-094).

3.4.3 Communication Settings

The console redirect port of the NAB-x CPU uses the following communication settings:

- Baud Rate = 19200
- Data Bits = 8
- Stop Bits = 1
- Parity = None

3.4.4 Viewing Console Redirect Messages

To view the console redirect messages:

1. Connect the consol redirect cable to an open serial port and the console redirect port of the NAB-x CPU.
2. Open the terminal emulator.
3. Configure the terminal emulator with the communications setting shown in section 3.4.3 *Communications Settings*.
4. Power up the NAB-x CPU.

For details of using the console redirect feature of the NAB-x CPU refer to the SCC *Troubleshooting Guide* (TSG), which can be found at www.SccControls.com.

3.5 Serial Number Tags

The serial number of the NAB-x CPU is located on both the CPU and enclosure.

4.0 Configuring IP Settings

This section covers the different methods used to configure the IP settings of the NAB-x series CPU.

4.1 SIP Command

This section provides details specific to the SIP command, which is used to configure the IP address of a NAB-x CPU. For full details of the command packets used in the SCC MUP refer to section 2.0 *General Command Structure.* Examples can be found in *Appendix C: Command Examples.*

Note that when using the SIP command the Group and Unit addresses specified in the packet must be Group 00 Unit 00.

The command syntax is:

ESC 'SSN' nnnnn ESC 'SIP' iii.iii.iii.iii 'M' mmm.mmm.mmm.mmm 'G' ggg.ggg.ggg.ggg

Where:

ESC is the ASCII escape code;

'SSN' is the character string 'SSN' (stands for System Serial Number);

nnnnn is the current serial number;

ESC is the ASCII escape code;

'SIP' is the character string 'SIP' (stands for Set IP);

iii.iii.iii.iii is the desired IP address;

'M' is the character 'M' (stands for Mask);

mmm.mmm.mmm.mmm is the desired subnet mask;

'G' is the character 'G' (stands for Gateway);

ggg.ggg.ggg.ggg is the desired gateway;

Note that all fields are not required. All of the following are valid:

<ESC>SSNnnnnn<ESC>SIP192.0.1.230

<ESC>SSNnnnnn<ESC>SIPM255.255.255.0

<ESC>SSNnnnnn<ESC>SIP192.0.1.230M255.255.255.0

After receiving a valid SIP command the new IP address will be displayed on the alpha-numeric marquee (if available) and unit will automatically reboot. The new settings will take effect after reboot.

4.2 Changing IP Settings Using an Ethernet Connection

This section describes the procedure for configuring IP settings over an Ethernet connection. This is the most common method, and does not require direct access to the NAB-x CPU.

4.2.1 Required Information

In order to change the IP address of a target device both of the following are required:

1. The current IP address.
2. The serial number of the NAB-x CPU.

Please refer to section 3.0 *Determining Current Configuration* for details.

4.2.2 Network Considerations

To configure the IP address of the NAB-x CPU using a direct Ethernet cable connection or through a hub it will be necessary to assign your computer an IP address in the same range as the current address of the NAB-x CPU.

If you are attempting to configure IP settings over a more complex network that may use gateways or other such devices, consult your network administrator for details.

4.2.3 Configuring IP Settings (Ethernet Connection)

The following procedure is used to configure the IP settings of the NAB-x CPU using an Ethernet connection:

1. Configure the IP settings of your computer as necessary. Refer to section 4.2.2 *Network Considerations*.
2. Open a connection to port 3001 at the current IP address of the NAB-x CPU.
3. Use the SIP command detailed in section 4.1 *SIP Command* to configure the desired IP settings.
4. The NAB-x CPU will automatically reboot.
5. The new IP setting will now be in effect.
6. If necessary reconfigure the IP settings of your computer for compatibility with the new IP settings of the NAB-x CPU.

4.3 Changing IP Settings Using a Serial Connection

IP settings can also be configured using a serial port on the NAB-x CPU. It is not necessary to know the current IP address of the CPU when using a serial connection, however direct access to the CPU is usually required.

4.3.1 Required Information

In order to change the IP address of a target device over a serial connection it is not necessary to know the current IP address. Only the serial number of the NAB-x CPU is required. Please refer to section 3.0 *Current Configuration* for details of obtaining this information.

4.3.2 Serial Connection

The NAB-x series CPUs support RS-232 and RS-485 serial connections. (Note: RS-485 is *not* supported by the NAB-9 series CPU.) When using RS-485 communications connect to the port labeled "Main RS-485". Location of the RS-232 serial port varies by model, please consult factory for details.

4.3.3 Configuring IP Settings (Serial Connection)

The following procedure is used to configure the IP settings of the NAB-x CPU using a serial connection:

1. Connect to the RS-232 or RS-485 port of the NAB-x CPU.
2. Use the SIP command detailed in section 4.1 *SIP Command* to configure the desired IP settings.
3. The NAB-x CPU will automatically reboot.
4. The new IP setting will now be in effect.

Appendices

Appendix A: ASCII Controls Codes

In the "Key" column in the table below, the caret (^) before each character represents the CTRL key on the keyboard. (Exception: $1E -- the second caret is the actual symbol. This is entered by simultaneously pressing ctl-shift-6).

Hex	Dec	Key	ASCII Name	ASCII Description	SCC Usage
$00	00	^@	NUL	Null	
$01	01	^A	SOH	Start of Header	
$02	02	^B	STX	Start of Text	STX
$03	03	^C	ETX	End of Text	ETX
$04	04	^D	EOT	End of Transmission	EOT
$05	05	^E	ENQ	Enquiry	ENQ
$06	06	^F	ACK	Acknowledge	ACK; also set specific cell
$07	07	^G	BEL	Bell	Sound alarm
$08	08	^H	BS	Backspace	BS
$09	09	^I	HT	Horizontal Tab	Cursor forward 1 position
$0A	10	^J	LF	Line Feed	LF
$0B	11	^K	VT	Vertical Tab	
$0C	12	^L	FF	Form Feed	Cursor home & clear display
$0D	13	^M	CR	Carriage Return	CR
$0E	14	^N	SO	Shift Out	
$0F	15	^O	SI	Shift In	Set 16 discrete outputs
$10	16	^P	DLE	Data Link Escape	Flash ON
$11	17	^Q	DC1	Device Control 1	Sound secondary alarm
$12	18	^R	DC2	Device Control 2	Flash OFF
$13	19	^S	DC3	Device Control 3	Set 1st 4 digit BCD output
$14	20	^T	DC4	Device Control 4	Set Cursor Position
$15	21	^U	NAK	Negative Acknowledge	NAK
$16	22	^V	SYN	Synchronous Idle	Display attribute off
$17	23	^W	ETB	End Transmission Block	Display attribute on
$18	24	^X	CAN	Cancel	
$19	25	^Y	EM	End of Medium	
$1A	26	^Z	SUB	Substitute	Set 32 discrete outputs
$1B	27	^[	ESC	Escape	ESC
$1C	28	^\	FS	File Separator	
$1D	29	^]	GS	Group Separator	Set specific cell
$1E	30	^^	RS	Record Separator	Set 2nd 4-digit BCD output
$1F	31	^_	US	Unit Separator	Set specific cell (2nd of 16)

Appendix B: Glossary of Acronyms and Abbreviations

AKA   Also Known As

EOT   End of Transmission (ASCII control code)
ESC   Escape (ASCII control code)
ETX   End of Text (ASCII control code)

MUP   Multi-Use Protocol

SCC   Static Controls Corporation
STX   Start of Text (ASCII control code)

TBD   To Be Determined

Appendix C: Command Examples

The following example assumes a NAB-x CPU serial number of 00000 and sets an IP address of 192.0.1.230 and a Subnet Mask of 255.255.255.0.

ASCII:

STX 00 00 ESC 'SSN' 00000 ESC 'SIP' 192.0.1.230 'M' 255.255.255.0 EOT

Hexadecimal Equivalent:

$02 $30 $30 $30 $30 $1B $53 $53 $4E $30 $30 $30 $30 $30 $1B $53 $49 $50 $31 $39 $32 $2E $30 $2E $31 $2E $32 $33 $30 $4D $32 $35 $35 $2E $32 $35 $35 $2E $32 $35 $35 $2E $30 $04