





StarBus-for-Ethernet versions 1.43 / 1.44

For updates, visit <http://starbus.com>

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**Quick Start — This page may be all you need !**

 In both command & data modes, SFE can only send serial data when the attached PC or controller asserts RTS (D9 pin 7 or D25 pin 4) – regardless of handshake setting. If you are in doubt as to the level of RTS, jump pins 6 & 7 at each 9-pin SFE port (DCE mode). Or jump pins 7 & 1 for SFE versions 1.44 or higher.

 After a few minutes UTP units automatically drop out of menu mode - if not connected to a hub. This is due to SFE's 'heartbeat', a self-addressed ping described in the section on network protocol.

- 1) Power up each unit and see the LEDs cycle through a start-up pattern and finally stabilize after 20 seconds or so with the C/D LED green (Centronics=Green, Data Products=Red), and the power LED on Red=Thin-net or AUI, Green=UTP. If you have more than one Ethernet port, set the internal links for the network connection you require (described later).
- 2) Connect all the units (at least two) to a single network segment or hub.
- 3) Connect a PC serial port or a terminal, set for 9600bd, 8, N, 1 to StarBus for Ethernet port 2 (CMD port - 9 pin D nearest the power cable). The serial ports are configured as DCEs, so a straight through cable is needed.
- 4) Type +++. See the root menu and the red 'Cmd' LED. This WAKE-UP character can be user-configured later.
- 5) Use the menu selection 'Display units on line' and ensure you have an entry for each connected unit; one local unit and one or more remote units listed below it. Note the firmware version displayed for each unit. It is best if they are all the same version - contact IMCO or your controls equipment dealer. Press SPACE or RETURN to return to the main menu.
- 6) Enter the 'Configure Unit' menu. The factory default password is 'pass' and the name is 'hitchhiker' (upper or lower case, with a double 'h' in the middle). Rename the unit to a unique name. Three IP fields may be required depending upon your application: a local IP address; one for the default gateway, and a network subnet mask. An IP address is needed if you plan to use embedded commands. The router gateway IP address and subnet mask are required if you plan to access a wide area network or use any routers. Enter IP numbers as dotted quads e.g. 158.152.46.132
  - Save the changes, *allowing a few seconds for the write cycle to complete* - This is important whenever you save any settings. Press any key to return to the main menu after the save operation.
  - Connect to each unit and repeat steps 4, 5 and 6. Once you have given each unit its own name (and optionally an IP number) you can configure it remotely.
- 7) Make a link between any pair of units that are connected to the same network segment. When prompted for Source and Destination unit names, enter their names (or IP numbers). Save the link. Exit command mode by pressing ESCAPE. Try passing data across the logical link you have made.

A good first try is to link port 2 on the local unit to port 2 on another unit. Make two wire links on the chosen remote units serial port 2 - D9 pin 2 to 3 (data loop back) and D9 pin 7 to 8 (CTS to RTS). You can then leave your PC/terminal connected to your local port 2, exit command mode (Esc), and then type characters which should echo back onto your screen, having been looped back by the remote unit.

 The parallel port behaves like a PC parallel port. I.e. it defaults to OUTPUT. If you are mating SFE to a printer, leave it at the default setting. If you are mating it to a PC, you must configure it as an *input* port.

- 8) Whenever you are configuring or linking to units on remote sub-nets, you must use IP numbers, not names.

In case of problems ... well that's why we wrote this manual. You are now ready to use your StarBus for Ethernet!

**WHATS NEW ?**

Your SFE contains a feature chip that controls the user interface and network functions. The manual assumes that your SFE is installed with v.1.43. After this section, no attempt is made to distinguish which features are available on prior versions.

This new feature chip is the culmination of a dramatic redesign to overcome packetizing effects of controls protocols, such as used with Andover Control's SX8000 front end. Compatibility is achieved by allowing the installer to configure settings for data kick-out parameters – such as packet size, character trigger, and time to transport from last RS-232 character.

If you are using SFE in a building controls application and with a version **lower than** 1.43, you should consider installing an upgraded feature chip. It adds significant functionality and overcomes interface limitations. Here is a partial list of upgrades and enhancements from versions 1.35 ~ 1.43 :

- Added RS-232 Char-Output Delay feature
- Repair of broadcast to port 1 problem
- Improved hardware handshake on port 1
- New Flash Rom (TFTP) support (optional)
- Addition of embedded APPLICATION SEQUENCE commands (like APSEQ in classic StarBus)
- Repair of reverse channel link to the current link initiator (see explanation above)
- Enhanced APPLICATION SEQUENCE to allow any character within command string (e.g. CR, LF, SP)
- Added a user set MENU wake-up character (formerly, this character was limited to ++++)
- Menu entry on Port-2 can be EITHER {AS}N or wake-up character
- Disables checks for the APSEQ when in menu mode
- Packet KICK-OUT delay can now be either time since last RS-232 character or absolute time (the basis of the StarBus 'ACK' setting which solved SX-8000/ACP problems in classic StarBus)
- Much tighter timeouts for Ethernet PKT SEND and ACK TIMEOUT
- Kick out packet when a certain character is received (e.g. line feed).
- (For Andover Controls applications): A new ACP setting scans data for ETX, ACK and EOT; then waits for the ACP checksum before packetizing. This prevents SX8000 and Nucleus packets from fragmenting.
- Embedded code responses like Armed-OK can be turned off. Also, eliminating the 'Error0' which had been an RS-232 response if the first characters of an application sequence were subsequently followed by non-{AS} string.
- The embedded connect code, e.g. {AS}C1.2.3.4P2 now uses a 20 second idle timeout instead of 2 sec.
- The link idle timeout is shown on screen - main menu 2 'Configure unit'.
- Timing interaction between SFE and Andover SX8000, Infinity, and Master AC256 were improved. In the past, the use of SFE to log onto controllers would sometimes generate repeated alarm data buffers, or 'error 100' conditions.
- Added digital I/O links (optional feature)
- Tightened up Startlink acceptance criteria
- Fixed link timeout value passed in Startlink
- IGMP (group multicast across routers - TFTP version)

**PC-SFE emulator or DOS Supervisory Tool (works with your PC/Ethernet card)**

StarBus-for-Ethernet does not require software to control functions or transmit data. Commands are entered through serial ports (via a menu or embedded in data). There are also two software versions: One allows a PC to perform supervisory functions, such as making and breaking links or viewing network maps, *without* a locally attached SFE. You are presented with a terminal window that behaves as if you have a locally attached box, but network commands are issued from your Ethernet card directly to the all the remote SFEs. This version cannot transmit or receive applications data.

Another application turns your entire PC into an SFE, which is then operated via the serial ports like any other unit (i.e. you must attach a terminal or a second PC to the rear of the emulator PC – you cannot run your application on the same machine). This x86 software costs less than purchasing the SFE hardware product, because you provide the hardware platform.

These software products are special order items. Call IMCO for details, or send e-mail to Dealers@StarBus.com

## **Changing packet send parameters**

Whenever data enters a serial port the unit has to make a decision about when to create a data packet and send it out to the network. You can adjust four settings that affect this:

1. The time the unit waits since the last data packet was sent

An internal timer relating to each serial input port counts down approximately every millisecond. If there is data waiting to send when it reaches zero, the data is formed into a packet and sent.

Valid choices for this value are 0 = never time out, 1 = 1ms, up to 127 = 127msec.

2. The time it waits after the last character was received from the RS232 port

Alternatively, you can choose to wait to see if more data is coming into the serial port before sending the packet. In this case the port timer is reset to the full value each time a character is received, but if it reaches zero, any characters waiting are formed into a packet and sent. The entered figure must be multiplied by 10 to give an actual time in msec.

Valid choices for this value are 0 = never time out, 1 = 10ms, up to 127 = 1270msec.


3. The number of characters to be sent in each packet

This setting allows you to choose the quantity of data which causes a data packet to be sent. The default is 256 bytes. When the chosen number of characters are present they are formed into a packet and sent. Valid choices for this value are from 1 to 256 bytes. This setting overrides the time-out settings, in that the unit never waits any longer once the chosen number of bytes are present.

4. Specify a 'trigger' character which causes the packet to be sent

This setting allows you to tell your SFE to look for a special character arriving from the port, and when it is seen form the waiting characters into a packet, with the special character on the end and send it. For example, use the value 10 (line feed) to send each line of text in its own packet. Valid choices for this setting are 000 to 253 decimal. 255 = no special end-of-packet character.

The value 254 optimizes performance for the Andover Control Protocol (ACP), used by SX8000 and Nucleus. This setting causes SFE to wait for an ACP checksum which follows the known end-of-packet character.

 Each input port is independent i.e. it is using its own copies of these parameters, but the values you select apply to all the input ports.

## **Statistics**

From the main menu a 'Display Statistics' menu selection provides a screen, mainly for diagnostic purposes, showing the packets sent and received by the local unit. Counts of total packets, and counts of different types of packets used in the protocol, are shown.

**Digital I/O** (optional feature)

Digital Input / Output may be selected as a configuration option when ordering. These two options provide a) four optically isolated input signals, suitable for sampling for example, a relay or switch contact and b) four open collector transistor outputs suitable for driving a relay coil.

The user can read the digital inputs at any SFE by using the menu system. This can also be used to read and change the states of the four outputs signals. In this way the user can monitor and control all the digital I/O on any unit from any unit. For example, use a relay to control the AC power to a piece of equipment and then, from any remote SFE:

1. cycle the power in the event of a lock up
- or 2. remotely turn on an equipment
3. perform a function
4. read the results
5. turn it off again

To use the menu system enter 'Configure Hardware ports', specifying the unit name, password and 'Configure Digital I/O port'. This screen shows the last recorded state of the four input lines and the last state that the four output lines were set to. It also offers the user the ability to set the states of the output lines to 'high' or 'low'. The 'U - Update unit' option actions any changes to the digital outputs which you have made, and then re-reads the inputs. Notice that the output lines are not changed until you perform the 'Update', so you can abandon without changes, by pressing ESC.

**Links Between Digital I/O Ports**


The user can set up logical 'links' between the digital I/O on two units. This links the four inputs on one unit to the outputs on another, and vice versa. Thus the states of the outputs reflect the states of the remote units inputs. The units look for changes of state of the input signals and pass these to the remote unit. Also the states of the inputs is automatically sent to the outputs once every minute or so. This option allows for example remote alarm outputs to be presented locally, local controls to be activated remotely and so on.

Use the main menu selection 1 - 'Set up a link' as normal, but choose port 4 to mean the digital inputs of the source unit, and choose port 4 to mean the digital outputs of the destination unit. Press Save. All changes of state at the digital inputs are sent to the destination unit to be mirrored on the digital outputs.

This logical link of inputs on one unit to outputs on another complements Main menu 2, option 4: 'Configure Unit' / 'Configure Digital I/O port' which allows the states of the inputs to be examined and the outputs states to be changed. Note that both these actions apply to the unit named when using main menu 2 - they do not apply to any unit linked to by that unit.

# Andover Applications (v1.39 ~ 1.43 only)

## SETUP FOR USE WITH ANDOVER CONTROLLERS (SFE hardware circuit K3a with firmware v.1.43 or lower)

 All SFE versions handshake on RTS/CTS (pins 7 & 8). But until recently, end-to-end flow control was sent on DTR/DCD (pins 4 & 1). Newer units – version 1.44 and higher – use DTR/DSR (pins 4 & 6). This page addresses primarily version 1.43. For version 1.44, see the next page.

SFE version 1.39 and higher incorporate features and performance enhancements designed to make StarBus-for Ethernet more robust when used in a controls environment. These settings are based on trials with a PC running SX8000 with a StarBus-for-Ethernet which links to a remote SFE on AC256 Master. Settings for Nucleus to Master should be identical.

- 1) **HANDSHAKE:** Set SX8000 and AC256 to Xon/Xoff, and set SFE at both ends to Bi-Directional Xon/Xoff. To ensure that SFE sees RTS=high on pin 7 of each 9-pin port, jumper SFE pins 6+7 (v.1.43 or lower), or pins 1+7 for v.1.44 and higher jumper. Alternatively, some dealers have better performance setting 12v from the 256 Master on pin 12.
- 2) Remember to set an APPLICATION SEQUENCE (see section on ‘Embedded Commands’). For these tests, we set the Application Sequence to: {AS}. E.g. literally, the characters “ { A S } ”.
- 3) Set the two SFEs to ACP protocol (packet kick-out character = 254). Packet send values:
  - Packet size 256 bytes (default)
  - Char = ACP (Important)!
  - 100ms from last character → (a catch all in case ACP setting leaves something behind; it could be made shorter)
- 4) Use a straight-through cable for SX8000 (or a 9-25 pin cable, which is free if requested with StarBus purchase). Check **DIRECT CONNECT** but not **TRACK CXD**. Set flow control (Xon/Xoff), and on the SFE to "Bi-directional Xon/Xoff".
- 5) SFE to AC256 Pin-outs (our thanks to Don Denette at Commercial Air)

| C-Port<br>25 pin Female | SFE 9-pin<br>Female | S-Port<br>25 pin Male | SFE 9-pin<br>Female |
|-------------------------|---------------------|-----------------------|---------------------|
| 2                       | --                  | 3                     | 2                   |
| 3                       | --                  | 2                     | 3                   |
| 4,5                     | --                  | 7,8                   | 5                   |
| 7                       | --                  | 5                     | 7,8                 |

1,7 if MK3a

see next page

| SX 8000  | SFE        | AC256 Port | Function                   |
|----------|------------|------------|----------------------------|
| Serial 1 | Serial 1   | C-Port     | SX 8000 communications     |
| Serial 2 | Serial 2   | S-Port     | SX 8000 unsolicited alarms |
| Lpt 1    | N/C        | N/C        | local alarm printer        |
| Lpt 2    | Parallel 1 | N/C        | remote alarm printer       |

Set serial 1 to multicast at all serial 1 ports (AC256 C-Ports). This will support more than one 256 can talk at the same time.

Set serial 2 to receive from all serial 2 ports (AC256 S-Ports). It strictly receives unsolicited alarms from multiple AC256 ports and hands them to SX 8000.

# Andover Applications (v1.39 ~ 1.43 only)

## SETUP FOR USE WITH ANDOVER CONTROLLERS (SFE hardware circuit K3a with firmware v.1.44 or higher)

At the time of this printing, cable-pin configurations for Andover Controls sites using newer SFE units are still being tested and documented. This page shows a cable configuration successfully implemented at several large SX-to-Master sites. Upon collecting additional feedback, we hope to add other configuration details for Master 256, SFE and – and if applicable – for Infinity and Continuum applications.

We have data from one site for which these settings do not seem to work, even though the site apparently uses the same AC256 / SX8000 network as other sites which are experiencing smooth operation with the configuration indicated. Until we resolve these difficulties, we do not consider these cabling suggestions to be officially released.

| AC-256   | --    | SFE | AC-256   | --    | SFE | SX       | ---      | SFE |
|----------|-------|-----|----------|-------|-----|----------|----------|-----|
| C-Port*  | 9-pin |     | S-Port*  | 9-pin |     | 8000     | 9-pin    |     |
| 25 Male  |       |     | 25 Male  |       |     | 9(or 25) |          |     |
| -----    | ----- |     | -----    | ----- |     | -----    | -----    |     |
| 1,shield | -     |     | 1,shield | -     |     |          |          |     |
| 2        | 3     |     | 2        | 3     |     | 2(3)     | 2        |     |
| 3        | 2     |     | 3        | 2     |     | 3(2)     | 3        |     |
| 4        | 7,1** |     | 7        | 5     |     | 5(7)     | 5        |     |
| 5        | 8     |     |          |       |     |          |          |     |
| 7        | 5     |     |          |       |     |          | jump 1,7 |     |

\* For C-Port to SFE, use DCE setting (it is the default SFE setting). For S-Port to SFE, use DTE setting.

\*\* Alternatively, some sites have experienced more consistent performance by connecting SFE pin 7 to AC256 pin 12, which is also held at 12v.

## 9-25 Adapters

a) Always use a straight-through cable or adapter, and never a "Null modem" adapter (see table below)... However, note that a 9-25 pin converter reverses pins 2 & 3 (this is called straight through)! If it did not swap pins 2 & 3, it would be a null-modem or 'reversing' cable. That is because the RS-232 spec for a 9 pin cable places the opposing signal on these pins.

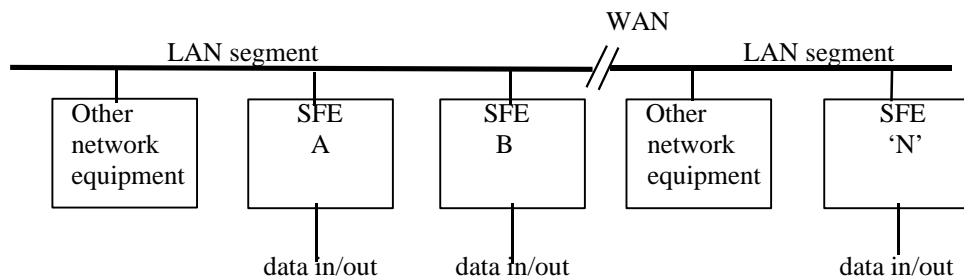
b) A 9/25 converter which was designed for use with a mouse is typically **NOT** pinned correctly, and may even contain jumpered pins at one end. These are typically the short rigid type of adapters. If in doubt, check the pin configuration against this table. We perform these tests by inserting the broken lead from a resistor into each hole in the 9-pin side and using an ohm meter set to beep when continuity is present.

| 9-pin | 25-pin | <== straight-through<br>9/25 adapter |
|-------|--------|--------------------------------------|
| ----- | -----  |                                      |
| 1     | 8      |                                      |
| 2     | 3      |                                      |
| 3     | 2      |                                      |
| 4     | 20     |                                      |
| 5     | 7      |                                      |
| 6     | 6      |                                      |
| 7     | 4      |                                      |
| 8     | 5      |                                      |
| 9     | 22     |                                      |

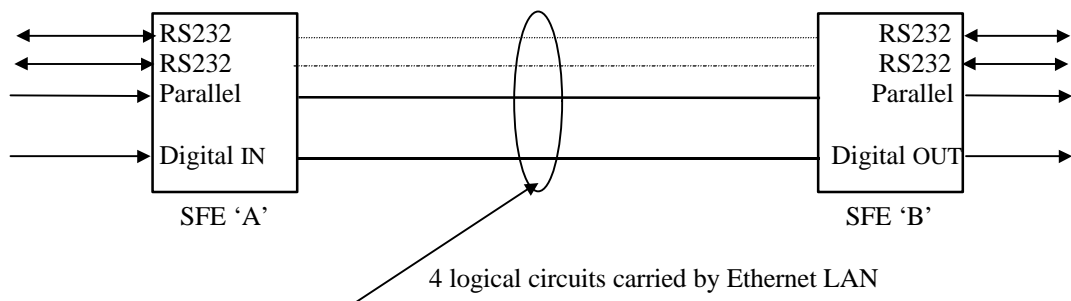
# StarBus for Ethernet

## Introduction

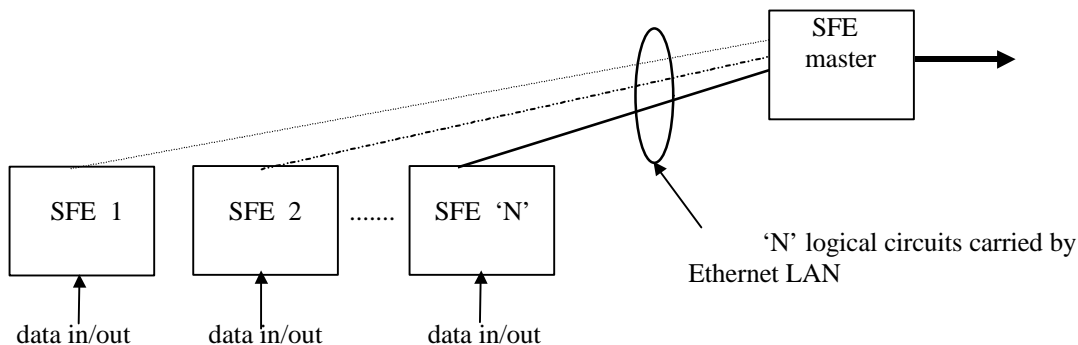
StarBus for Ethernet™ [SFE] lets your serial and parallel data travel through any ethernet, allowing your network to be used for control data transport tasks without interfering with normal network operations. The units are 802.3 compliant and use protocols from the TCP/IP suite, so they are fully routable and because they only use ethernet capacity when carrying data – they have very little affect on overall network performance.



Each unit has two RS232C ports, a parallel port, eight optional general purpose in/out signals and a network port (choose thin net, UTP or AUJ). You may connect as many units as you wish to the network and establish logical connections between units with complete flexibility. For example, imagine two units each connected to a network, but at some distance from each other. The three ports (and also the optional digital I/O pins) may be set up as shown below so that they all carry data simultaneously -



Although the above example shows the four ports linked in a one-to-one fashion to another unit, SFE allows its ports to be individually linked to any port of any other unit. You can connect as many SFEs as you wish to your network, obeying normal Ethernet rules, and set up connections between units with complete freedom. For example, set one unit to accept data from several other units -



These, and many other configurations can be easily set up, monitored and changed at will from any unit on the network or optionally, from any PC equipped with an ethernet card and optional supervisory software. From the command mode menu



# StarBus for Ethernet

or via a user-programmed, embedded APPLICATION SEQUENCE, you can make/break links, examine/change configurations, unit names, IP numbers etc - for any SFE on the network. Security is provided by a password for every unit.

SFE provides error corrected, self repairing links. Data packets are also sequence numbered to ensure error free delivery. If power or the network fails, SFE *automatically* re-establishes each link when the problem is resolved!

## **Pre-Connect Configuration**

Before using any StarBus for Ethernet, you must set a few configuration parameters. Settings remain in non-volatile storage for each subsequent power-up, until changed by you. First, each unit requires a unique name and/or IP number. Power up the unit and allow the initialization sequence to run until only the ON and C/D LEDs remain lit.


SFE is configured by an RS232 terminal (or PC running a terminal emulation program) connected to serial port 2, which is the D9 connector nearest the power cable. The serial ports are configured as DCE, so a normal PC serial cable can be used without crossovers. Alternatively, an internal strap allows the selection of DTE operation.


To enter the Command menu mode type ++++ into port 2 or press the concealed MODE button recessed behind the front panel. The Serial port #2 'CMD' LED lights and the SFE root menu appears. A menu tree is shown at the end of this manual. A new or cold started unit will ask you to enter its IP address, the IP address of the default gateway and the subnet mask. Use a number provided by your network manager, or if all the units are going to be on the same LAN segment with no routers (gateways) in the system you can invent IP numbers. For example, assign the default gateway number 1.1.1.1; assign IP no. 1.1.1.2 through to 1.1.1.255; and use a sub-net mask of 255.255.255.0

Next, rename each unit to suit your site. You may also change passwords, port names, port settings, IP number, default gateway and subnet mask from this menu. Settings are changed using selections in the CONFIGURE UNIT, menu:

- At the prompt 'ENTER NAME OF UNIT TO CONFIGURE', type the factory default 'hitchhiker' (double 'h' in the middle).
- At the prompt 'ENTER PASSWORD FOR UNIT', type the factory default 'PASS' in upper or lower case.
- Rename the unit. If desired, change the password.


If you wish to change the port names enter the CONFIGURE PORT menus for each port. The factory default port names are: serial port 1 = 'port1'; serial port 2 = 'port2'; bi-directional parallel port (D25 female) = 'port3'.

 To configure or link a unit on remote subnet, enter an IP number when prompted for the unit name.

 Remember to *Save* your changes before escaping from command mode.

## **Connecting to the Network**

Enter COMMAND MODE at any unit. Select 'DISPLAY UNITS ON LINE' to list all SFEs on the local LAN segment. You will not see units on other subnets. The selection 'PRINT LIST OF UNITS ON LINE' will send the list of connected units to the local parallel port (set it as an output port). These options are a good test of the unit's ability to communicate correctly on the network. You should see LEDs flash for outgoing and incoming network packets.

 SFE responds not only to other SFE transmissions –but also to any valid network broadcasts

# StarBus for Ethernet

## Making Links

You can now form links between units. A 'link' is a virtual data path from a source port to a destination port on a remote unit. Source and destination ports may differ (serial or parallel) and port configurations at each far end do not need to match (baud rate, data bits, parity, etc.), although these parameters must match the directly mated RS-232 equipment.

The SET UP LINK menu gives the prompt: 'ENTER NAME OF SOURCE UNIT'. If you enter a name, the unit searches the local subnet. If found, you are prompted to enter its password. Alternatively, you may enter an IP number, and no search is performed. Next you are asked to identify the source port number, 1, 2, 3 or 4 for digital I/O. You are then prompted for the name of the Destination unit (or 'none' or 'multi'...see details below). You may enter a name or IP number as before. You will be prompted to identify the destination port number on that unit - if you chose digital I/O (port4) on the source, you must choose port 4 on the destination too. Last, you will be prompted for a time-out. This value is passed to the destination output port, and it prohibits other users from connecting to that port until it has been empty and idle for the chosen time. Choose 2 sec, 20 sec, 2 min or 'never'. Having set the link, either SAVE -or- ESCAPE to exit without changes.

## Wide Area Network Routers

If you connect units on different subnets of a WAN system you *must* refer to units by their IP numbers and you must define default gateways and subnet masks for every unit. Your network administrator can provide this information. If you connect all units to one subnet, IP numbers can be ignored or invented (use any dotted quad). Multicasts can be made across network routers only with the optional SNMP hardware platform (SFE2).

## Responding to the 'Unit Name' Prompt

When prompted to enter a unit name you can enter either -

1. The user-assigned name of a remote unit.


This causes your local station to perform a real-time inquiry, which maps the name to a specific unit. But this occurs only on the local subnet. Names cannot be used for links across routers to units on other subnets.

2. An IP number      This technique supports links to units situated on remote subnets
3. The word 'none'      This will clear a previously set link.
4. The word 'multi'      Used to set up data broadcast from one unit to many units. See below.


## Data Broadcast (local subnet multicast)\*

Data broadcast may be selected as a link option on any input port by using the special word 'multi' instead of the name of a destination unit. Data arriving at the broadcasting source port is sent to all other SFEs connected to the local subnet.\* and then output via the port you selected as destination.

For example, specify unit John/port 1 as the source unit port. Enter 'multi' as the destination unit name. Select a destination port (e.g. Port 2), and all data arriving at John/port 1 will be sent to port 2 of every other SFE on the local network.

 (\*) This option broadcasts to all units on the same subnet. Multicasting to units on different networks requires IGMP addressing, which is a feature of SFE2 (our SNMP hardware platform only).





 To use broadcasts, you must assign IP numbers and subnet masks to all units.

 Broadcast data travels as multicast packets (broadcast bit is set in destination MAC address field. Multicast packets are unicast (they are not acknowledged by receiving units). When a unit is in broadcast mode, all its data is sent as a broadcast.

# StarBus for Ethernet

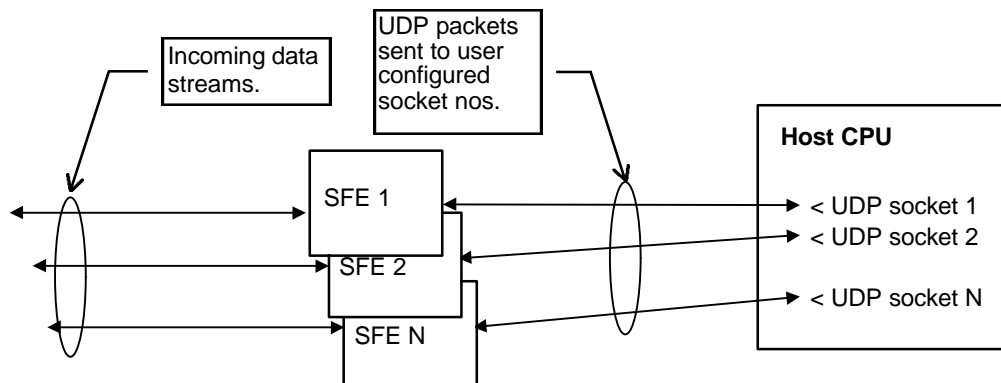
## Reverse Channel Data [using Data Broadcast]

If a serial port is selected as the 'multi' destination of a broadcast, the remote equipment can respond to the broadcast data and establish full duplex links back to the broadcast unit. In the previous example, let's say that StarBus units receiving the broadcast data are connected to terminals displaying the broadcast data. If a terminal user typed a key, its SFE would establish a full duplex link back to the broadcast unit and then send the keystroke back to it. If another terminal user typed, its SFE may have to wait for the idle time out at the broadcast unit to elapse before it can send its data. So every unit can send back to the broadcasting unit, but each may have to wait for the broadcast unit's reverse channel to be free. Because of this sharing, it may be best to set the idle time out of the broadcast unit as short as possible - i.e. 50ms.

-  You must assign IP numbers and subnet masks to all units.
-  Clear broadcast links by typing the special word 'none' instead of a destination unit name.
-  In the reverse channel link example above, each user typing data back, has exclusive use of the broadcasting unit until its idle time out elapses. Then any other unit can gain access.
-  When a reverse channel link is made in this way, data from the broadcasting unit is still in broadcast mode - so every other unit on the subnet hears half of the full duplex conversation between the two.

## UDP socket to socket links (ver 1.43 and higher)





Your StarBus for Ethernet can be configured to send and receive 'raw' UDP packets; e.g. the UDP data field will not contain the underlying rugged HitchHiker protocol. Use this type of configuration to send data to a host CPU -



## To make a raw UDP link -

- 1) Use Main Menu 2 - Configure Unit: Enter IP number, IP of default gateway, and sub-net mask. Be sure to SAVE.
- 2) Use Main Menu 1 - Set up Link
  - Enter IP number of source unit, and enter its password
  - Enter source port # - (must be RS-232 ports 1 or 2)
  - Enter name of destination unit in the special form - **UDP IPnumber Socketnumber** (e.g. to make a raw UDP link to UDP socket 7200 on host 152.48.158.39 enter **UDP 152.48.158.39 7200** (the spaces are important)!
- 3) Save setting. Note that link information for this unit now shows UDP socket no. in parameter normally used to name the port. Additional important notes . . .

# StarBus for Ethernet

-  To make a bi-directional raw UDP link between two HitchHikers, it is necessary to make a link on each unit pointing to the appropriate socket number on the other.
-  Do not use socket number 8500 or socket number 256 or below. (SFE 'normal mode' packets use 8500 for both the source and destination sockets numbers).
-  If you link to a UDP socket on your host that is not in use by some process, it may respond with an ICMP 'destination unreachable' message. SFE ignores these.
-  There is no end to end flow control when using raw UDP links. The receiving equipment must remove the incoming packets as quickly as they arrive.

## Serial Port Configuration

This menu allows setting baud rates in the range 110 to 38K4, 7 or 8 data bits, odd, even or no parity, 1 or 2 stop bits. Default settings for the serial ports are 9600 baud, 8 data bits, No parity, 1 stop bit, and Xon/Xoff control on output only.

### Output Character Delay (ver 1.36 and higher)

The serial port configuration sub-menu also allows an inter-character delay of between 0 and 255msec (approximate) to be selected. The effect of setting a value other than 0 is that SFE waits for the chosen delay time between outputting characters to the serial port, slowing down the data stream. This may be useful when connecting a SFE to equipment that can be overrun by a continuous stream of characters.

### Handshake (flow control)

Whenever you make links between units, one unit will be connected to a source of data. i.e. a piece of equipment sending data, and the other unit will re-output this data to some receiving equipment.


For example, a host computer outputs serial data to 'port1' on a unit named 'JIM', which is linked to parallel 'port3' on a unit named 'LASER'. In this case you must correctly configure Jim's serial 'port1' handshake. To do this enter CONFIGURE HARDWARE PORTS, and specify the unit name, password and port number. Then enter the HANDSHAKE menu. SFE can generate handshakes, to stop/start a data source, in two ways:

1. By either raising and lowering its CTS output - select 'Hardware' handshake
2. By sending Xon and Xoff characters - select 'Input generating Xon/Xoff' handshake

SFE responds to handshakes from equipment trying to stop/start data out of a destination port in two ways:

1. By monitoring the incoming RTS signal - select 'HARDWARE' handshake
2. By looking for incoming Xon Xoff characters - select 'OUTPUT RESPONDING TO XON/XOFF'




Factory default for both serial ports is 'OUTPUT RESPONDING TO XON/XOFF'.

-  Even with 'OUTPUT RESPONDING TO XON/XOFF', data is not sent out of the serial port until RTS (into the port) is true. Strap it to +12v (pin 6 to pin 7) - or ensure that connected equipment asserts it. This differs from classic StarBus-UTP, which uses CTS/DTR for hardware handshake, rather than RTS !

# StarBus for Ethernet

## End to end flow control

If a link is made from serial port 2 on one unit to serial port 2 on another, their ports may be configured so that the state of the DTR input (pin 4) on the source unit is passed to the DCD output (pin 1) on port 2 of the destination unit. Likewise, the state of the DTR input on the destination unit is passed back to DCD output on the source unit. In this way the link passes not just data each way, but the state of a control signal too. To set this option enter 'CONFIGURE HARDWARE PORTS', specifying the unit name, password and port number 2, and then enter the 'HANDSHAKE' menu selection. Select 'DTR/DSR direct end-to-end' (plus one of the above). Save your choice, and then perform the same configuration steps on the second unit in the link. While you were in the handshake menu you will have noticed the option to disable end to end flow control, should this be needed at some future time.

-  Remember to save the changes before you exit
-  Incorrectly set handshakes result in loss of data
-  RTS input (D25 pin 4 / D9 pin 7) must always be TRUE to allow data out (COMMAND & DATA modes)

## **Parallel Port**

Parallel ports do not require user-set flow control. However, there are other configuration considerations. The PARALLEL PORT sub menu allows selection of input –vs– output Centronics (normal) –vs– Data Products (usually for high speed line printers). If in doubt select CENTRONICS. factory default is OUTPUT = CENTRONIC PORT.

## **Changing Packet Send Parameters**

Whenever data enters a serial port the unit has to make a decision about when to create a data packet and send it out onto the network. You can adjust three settings that effect this by changing -

- The time the unit waits since the last data packet was sent
- The time it waits after the last character was received from the RS232 port
- The number of characters which trigger a packet to be sent

### Elaboration . . .

1. The time the unit waits since the last data packet was sent (ver 1.38 and higher)

For each serial port, an internal timer counts down every 10 msec. If there is data waiting to send when it reaches zero, the data is formed into a packet and sent. The entered figure must be multiplied by 10 to give an actual time in msec and valid choices for this value are 0 = never time out, 1 = 10ms, up to 127 = 1270msec.

2. The time it waits after the last character was received from the RS232 port . . .

# StarBus for Ethernet

Alternatively, you can choose to wait to see if more data is coming into the serial port before sending the packet. In this case the port timer is reset to the full value each time a character is received, but if it reaches zero, any characters waiting are formed into a packet and sent. As before, the entered figure must be multiplied by 10 to give an actual time in msec and valid choices for this value are 0 = never time out, 1 = 10ms, up to 127 = 1270msec.


### 3. The number of characters which trigger a packet to be sent

This setting allows you to choose the quantity of data which causes a data packet to be sent. The default is 256 bytes. When the chosen number of characters are present they are formed into a packet and sent. Valid choices for this value are from 1 to 256 bytes. This setting overrides the time-out settings, in as much as the unit never waits any longer once the chosen number of bytes are present.

### 4. Specify END-OF-PACKET character (causes data packet to be closed and sent – ver 1.39 and higher)

This setting allows you to optionally designate a special character which directs the local SFE to immediately close the current RS-232 data packet and transmit it onto the Ethernet as soon as possible. The feature is useful in certain applications that expect very fast remote acknowledgements to short outgoing messages. For example, use the value 10 (line feed) to send each line of text in its own packet. Valid choices for this setting are 000 to 253 decimal. 255 = no special character. The value 254 optimizes performance for Andover Control Protocol (ACP). Use 254 for any applications that use Nucleus or SX8000.

If you do not set this parameter (i.e. leave it at the default value 255), the packet-send criteria will be based upon the max packet length or the max delay setting between RS-232 characters (both described above). As additional characters are received at the local serial port, they are not lost... rather, they simply begin a new network packet for transmission at such time as the next packet send criteria is met (packet full, delay between characters received, or triggered by an end-of-packet character).

 Each input port is independent. I.e. They use their own copies of these parameters, but the values you select apply to all input ports.

## **Statistics**

The 'Display Statistics' menu selection produces a screen mainly for diagnostic purposes. It shows packets sent and received by the local unit, as well as a count of total packets and different types of packets used in the protocol.

## **Digital I/O** (optional feature)

SFE may be factory ordered with 4 contact sense inputs and four TTL outputs at each station. Isolated inputs are suitable for sampling (e.g. relay or switch contact) and each output is an open collector transistor suitable for driving a relay coil.

The user can read the digital inputs at any SFE by using the menu system. This can also be used to read and change the states of the four outputs signals. In this way the user can monitor and control all the digital I/O on any unit from any unit. For example, use a relay to control the mains power to a piece of equipment and then, from any remote SFE –

- remotely turn on an equipment
- cycle the power in event of lock-up
- perform a function
- read results
- turn it off again

# StarBus for Ethernet


To use the menu system enter CONFIGURE HARDWARE PORTS, specifying the unit name, password and CONFIGURE DIGITAL I/O PORT. This screen shows the last recorded state of the four input lines and the last state that the four output lines were set to. It also offers the user the ability to set the states of the output lines to HIGH or LOW. The U - UPDATE UNIT option actions any changes to the digital outputs which you have made, and then re-reads the inputs. Notice that the output lines are not changed until you perform the UPDATE, so you can abandon without changes, by pressing ESC.


## Links between digital I/O ports

The user can set up logical 'links' between the digital I/O on two units. This links the four inputs on one unit to the outputs on another, and vice versa. Thus the states of the outputs reflect the states of the remote units inputs. The units look for changes of state of the input signals and pass these to the remote unit. Also the states of the inputs is automatically sent to the outputs once every minute or so. This option allows for example remote alarm outputs to be presented locally, local controls to be activated remotely and so on.

Use the main menu selection 1 - SET UP A LINK as normal, but choose port 4 to mean the digital inputs of the source unit, and choose port 4 to mean the digital outputs of the destination unit. Press Save. All changes of state at the digital inputs are sent to the destination unit to be mirrored on the digital outputs.

This logical link of inputs on one unit to outputs on another compliments Main menu 2 'CONFIGURE UNIT' – option 4, 'CONFIGURE DIGITAL I/O PORT' which allows examination of inputs and changing of outputs. Both actions apply to the unit named when using main menu 2 - they do not apply to any unit linked to by that unit.

 The I/O ports are separate bit-oriented toggles. An INPUT port is linked to an OUTPUT port. Therefore, 2-way digital I/O link would involve four I/O ports; one complimentary pair for each direction.

 Configuration or linking of a digital I/O port applies only to the named unit when using main menu 2. It does not apply to the unit linked. It must be examined, configured or linked as a separate action.

# StarBus for Ethernet

## APSEQ — Embedded StarBus Commands (ver 1.25 and higher)

Examples used throughout most of this manual assume that a user is interacting directly with SFE menus, selecting options as appropriate. This presents difficulty for control equipment applications or front-end software. Commands sent into the menu interface may present responses which require analysis and action by the user. Furthermore, the menu interface incorporates handshake and timing delays to account for terminal / text output.

Both serial ports now support a subset of the embedded commands used in classic Busdrivers. These commands are used in automated environments where the normal user interface is less appropriate. Do not awaken an SFE to use these special commands. Just as with classic StarBus Busdrivers, they are slip-streamed within the data mode. You may make and break links, or flush the transmit buffer and immediately break a link.




Each embedded command begins with an Application Sequence of between 1 and 10 user-defined characters. In the descriptions of the commands below this is represented by {AS} and could be for example ~ <ctl-z> # <space> ! or any other string that is unlikely occur naturally in applications data.

The Application Sequence is entered from Main Menu 2 (Configure Unit), Option A. For non-printable characters, precede the 3-digit decimal value with a back slash. E.g. \013=CR, \010 = LF. To enter the backslash character itself, use either two back slashes or use the decimal method just described. This entry: FRED\SUE\013\010 yields: FRED\SUE\r\n

### APSEQ Commands

|                              |                      |   |
|------------------------------|----------------------|---|
| Connect                      | {AS} C<IP#> P<port#> | Example: \<sp-cr-lf>APSEQ\C1.2.3.4P1            |
| Disconnect (but finish xmit) | {AS} D               | Equivalent to Make Link menu: destination=NONE  |
| Forced disconnect            | {AS} X               | Flushes RS-232 buffer at port where it is used  |
| Enter menu system            | {AS} N               | Use with serial port 2 only. Like typing '++++' |

Apart from {AS}N, which can only be used on port 2, commands always apply to the source unit and source port which receives the command. The command {AS}C1.2.3.4P1 into port 2 links this port to port 1 on a remote unit with IP number 1.2.3.4. The command {AS}D into the same port disconnects the link (identical to using the menu system, and choosing 'Make a link' – Destination 'NONE'). The forced disconnect {AS}X is the same, but is executed immediately, thereby flushing any unsent RS-232 data from the packet currently filling any backed up packets awaiting a network slot. The ENTER MENU command {AS}N only applies to serial port 2, and returns control to the menu user interface.

-  Do not set a kick-out size of less than 27 bytes! This minimum packet restriction is equal to the maximum possible APSEQ (10 bytes) plus the maximum length connect command (up to 17 bytes).
-  With traditional Busdrivers, you may have preset a special APSEQ string by pressing CTL-A from within the INIT PARAMETERS menu. There is no equivalent preset command in StarBus for Ethernet. If you plan to use embedded commands, set the desired {AS} string from the menu system.
-  Because of the nature of Ethernet links and the way in which SFE differentiates between commands and data, it is necessary to wait until the data output buffer is empty before proceeding with your AS string. Normally this can be achieved by pausing for a second before using the DISCONNECT command. However, in applications where you fear a significant data backup then you must first send a FORCED DISCONNECT command before proceeding with a new CONNECT or DISCONNECT command. Such situations might occur if the remote device is frequently handshake off or is much slower than the local sending unit, or if the entire Ethernet is fully saturated).



# StarBus for Ethernet

## StarBus Embedded Command Responses

Response to your embedded commands may be toggled ON or OFF, using the sub-menu where the {AS} was entered. The optional command response is sent back to the local port where the command was issued:

- **Armed-** SFE acknowledges a valid application sequence
- **Armed-OK** valid application sequence followed by a valid command
- **Armed-Error1** valid application sequence, but the command is not recognized

*The remainder apply only to the CONNECT command*

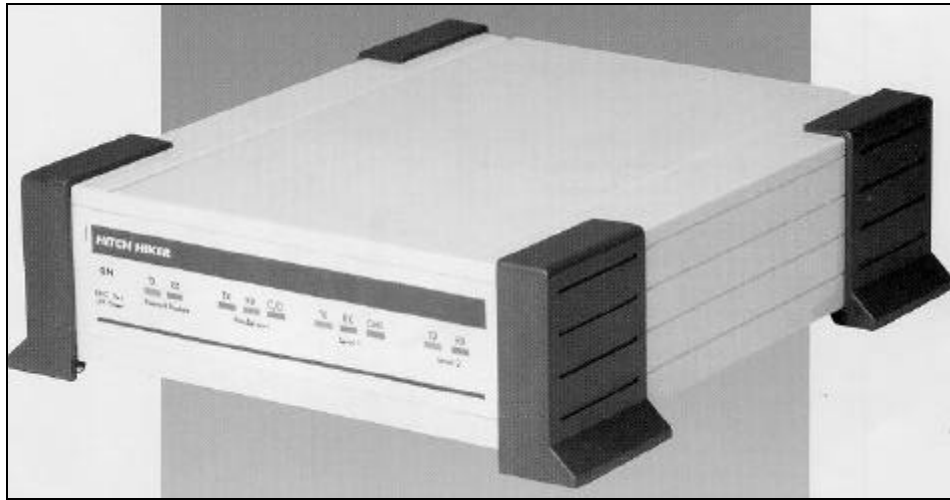
- **Armed-Error2** valid application sequence, but the IP number is too long
- **Armed-Error3** valid application sequence, but the IP number is badly formatted
- **Armed-Error4** valid application sequence, but the port number is not 1,2 or 3

## Changing the Menu Wake-Up Character (ver 1.37 and higher)

The unit responds to a repeated character entered at typing speed into port 2 by entering the menu system. The default character is +. Main menu 2, sub-menu B allows the selection of any single printable character to perform this function.

# StarBus for Ethernet

## Specification

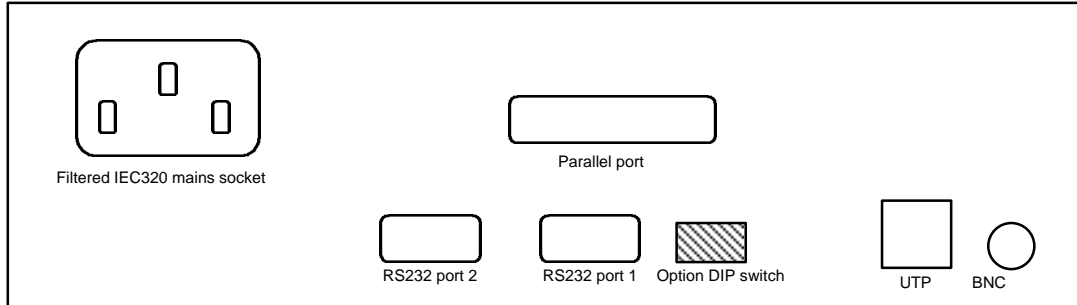


|                           |  |
|---------------------------|--|
| Serial Ports<br>(9 pin)   | Two full-duplex RS-232 ports (DB-9 connectors). Speed up to 38.4 Kbps; data 7 or 8 bits; stop bits 1 or 2. All handshake signals: RTS/CTS/DTR and DCD (Carrier Detect).  |
| Parallel Port<br>(25 pin) | D25 female. User set to IN or OUT can be user set to any of 3 interface standards: Centronics, Data Products, or Data General. LED confirms selection.   |
| Control I/O<br>(optional) | Four optically isolated inputs are suited to detect relay closure or signal transition. And four TTL outputs suitable to drive a relay coil, signal, or LED. A/D conversion is also available.   |
| Network Interface         | 10 Mbps Ethernet [IEEE 802.3]. Factory configured with your choice of <u>1 or 2 of 3</u> interfaces options : 10Base-T (UTP) 100 meter/seg, 10Base-2 (BNC) 185 meter/segment, and/or 10Base-5 (AUI). All are TCP/IP! For 2-port option, LED indicates network port in use. Each unit stores IP routing. Transparent to legal bridges and routers. Encapsulates IP packets, as defined in RFC 894. IP, ARP, ICMP and UDP. |
| Power                     | 120 or 240 VAC (12 watts). No external powerpack required. Once purchased, units can be changed from 110 to 220v and back via swapping the internal transformer center tap input (minor solder work).  |
| Indicators                | LEDs provided for each port: <ul style="list-style-type: none"><li>• LAN 3-color red/green shows BNC or UTP selected. Also acts as power confirmation.</li><li>• Traffic LEDs for TRANSMIT and RECEIVE packets</li><li>• Serial ports LEDs for Tx data, Rx data and 'COMMAND' mode</li><li>• Parallel port LED for Tx data, Rx data and red/green for Centronics or Data Products selection</li></ul>                    |
| Controls                  | Parameters are stored in non-volatile memory. Pushbutton or StarBus APPLICATION SEQUENCE to enter COMMAND mode. Master reset to factory defaults by internal switch.   |
| Physical                  | 10 x 8½ x 3". 5 lbs. Metal with electrically bonded panels (Meets EMI/RFI standards): Feet for tabletop use are included. Rack mount kit available.  |
| Stored Configuration      | IP addresses, port settings, logical links, etc. saved in internal non-volatile memory.  |
| Environmental             | 32~104 °F (0~40 °C), 5 to 95% humidity (non-condensing).   |

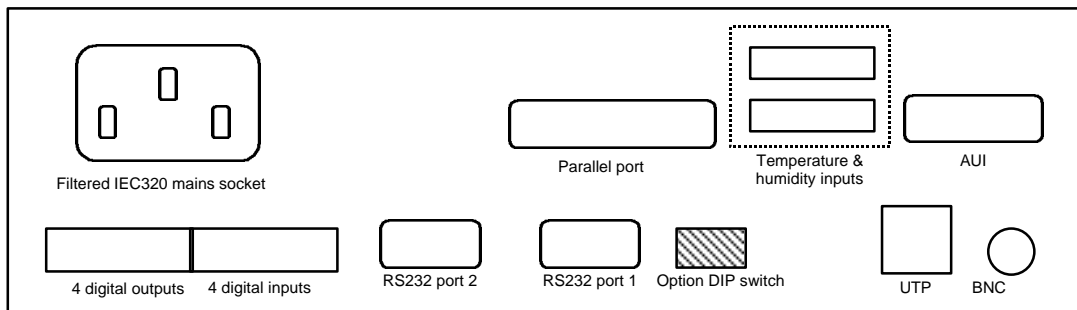
# StarBus for Ethernet

- Rear panel connectors (some configurations may vary)

1) Standard network configurations — Although 2 ports are shown, normally only one network port is fitted.



2) Fully configured — All optional hardware features installed



## Serial port pin connections — DTE / DCE links (Factory default: DCE configuration)

| <i>Signal name</i> | <i>Serial port 1</i> | <i>Serial port 2</i> |
|--------------------|----------------------|----------------------|
| DCD out of unit    | 1 (+12v)             | 1                    |
| Data out of unit   | 2                    | 2                    |
| Data into unit     | 3                    | 3                    |
| DTR into unit      | ignored              | 4 (V1.43 onwards)    |
| Signal ground      | 5                    | 5                    |
| DSR out of unit    | 6 (+12v)             | 6 (+12v)             |
| RTS into unit      | 7                    | 7                    |
| CTS out of unit    | 8                    | 8                    |
| ( unused )         | 9                    | 9                    |


## Switching to DTE configuration

To obtain this configuration disconnect the unit from the power, remove the top lid by unscrewing the two screws on the rear panel. DCE/DTE links are found adjacent to the serial connectors. Silk screen labeling on the printed circuit board show the two sets of link positions - 'PORT A' refers to port 1.

( table appears next page )


# StarBus for Ethernet

| <i>Signal name</i> | <i>Serial port 1</i> | <i>Serial port 2</i> |
|--------------------|----------------------|----------------------|
| DCD into unit      | ignored              | 1                    |
| Data into unit     | 2                    | 2                    |
| Data out of unit   | 3                    | 3                    |
| DTR out of unit    | 4 (+12V)             | 4 (+12V)             |
| Signal ground      | 5                    | 5                    |
| DSR into unit      | ignored              | ignored              |
| RTS out of unit    | 7                    | 7                    |
| CTS into unit      | 8                    | 8                    |
| N/C                | 9                    | 9                    |

 Pins labeled +12v are permanently asserted 'TRUE'

## **Parallel port pin connections** (Factory default: Centronics output port)

| Centronics signal names. | Output port direction. | Input port direction. | Pin number | Data Products signal names.* |
|--------------------------|------------------------|-----------------------|------------|------------------------------|
| /strobe                  | out                    | in                    | 1          | strobe                       |
| data bit 0               | out                    | in                    | 2          | da0                          |
| data bit 1               | out                    | in                    | 3          | da1                          |
| data bit 2               | out                    | in                    | 4          | da2                          |
| data bit 3               | out                    | in                    | 5          | da3                          |
| data bit 4               | out                    | in                    | 6          | da4                          |
| data bit 5               | out                    | in                    | 7          | da5                          |
| data bit 6               | out                    | in                    | 8          | da6                          |
| data bit 7               | out                    | in                    | 9          | da7                          |
| /acknowledge             | in                     | out                   | 10         | n/a                          |
| busy                     | in                     | out                   | 11         | demand                       |
| paper end                | in                     | out                   | 12         | n/a                          |
| select                   | in                     | out                   | 13         | n/a                          |
| n/c                      |                        |                       | 14         | n/c                          |
| /fault                   | in                     | out                   | 15         | n/a                          |
| /init                    | in                     | out                   | 16         | n/a                          |
| /select                  | in                     | out                   | 17         | n/a                          |
| ground                   |                        |                       | 18-25      | ground                       |

 This is a minimum subset of the signals needed for Data Products interface support. We recommend use of IMCO supplied cables.


## **Option DIP switch settings.**


Most SFE hardware configurations are fitted with a 6-button DIP switch accessible from the rear. If your SFE has these switches, their functions are (*not* applicable to internal 4-button DIP switch):

| <u>Switch no</u> | <u>Function</u>                        |
|------------------|--|
| 1 off, 2 on      | UTP                                    |
| 1 on, 2 on       | BNC                                    |
| 1 on, 2 off      | AUI                                    |
| 3 on             | Reset factory defaults ('cold' start)* |

# StarBus for Ethernet

- 4 reserved
- 5 reserved
- 6 on reset to factory defaults (factory or 'very cold' start) \*\*

 (\*) Switch on and then power up the unit. After a few seconds switch to off again. The factory default name is **HitchHiker** and the password is **pass**.

 (\*\*) Switch 6 only functions on units fitted with optional Flash ROM / TFTP (i.e. enhanced features such as SNMP and IGMP). Do not do a 'very cold start' unless you are prepared to TFTP a new copy of the operational firmware to the unit. (TFTP is a subset of FTP file transfer protocol). Firmware is provided as a file called HHTFTP.BIN. Note that the IP number defaults to **1.1.1.44**

## Restoring factory defaults

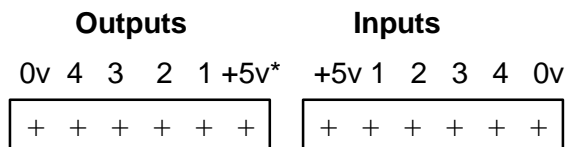
Two methods are provided to restore factory settings. In almost every circumstance, a software rest (first paragraph, below) is sufficient to return a StarBus for Ethernet to its original factory settings.

1. Use the menu system and enter 'Configure unit', specifying the local unit name (or IP number), and password, and then use the 'Restore factory defaults' menu selection.
2. Disconnect the unit from power. If your unit has a 6-DIP switch accessible from the rear panel, set DIP switch 3 ON (If you do not see switches on the back panel, you must open the unit and locate the blue 4-DIP switch on the circuit board. In this case, temporarily set switch 4 ON). Turn the power to the unit on and after a few seconds reset this same switch back to the off position.

You will need to reset the unit and port names as well as the various IP numbers. Remember that the default names are: Unit → hitchhiker, Password → PASS, Port #1 → Port1, Port #2 → Port2.

## Digital I/O Terminal Connections (optional feature)

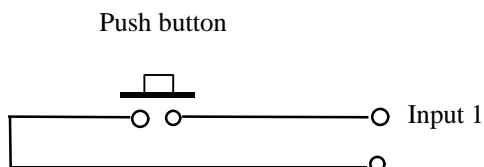
Pin outs of the two part screw connectors for the digital I/O -



\* may be set to +12v by internal link.

Use of the digital inputs and outputs -

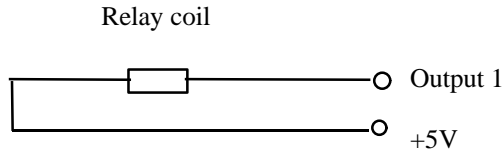
The four input lines are optically isolated. An example of how to drive these pins from a 'voltage free dry contact' e.g. a switch or relay contact, is shown below -



# StarBus for Ethernet

0V

Four outputs lines are open collector transistors. An example of how to use these to drive the coil of a relay is shown -

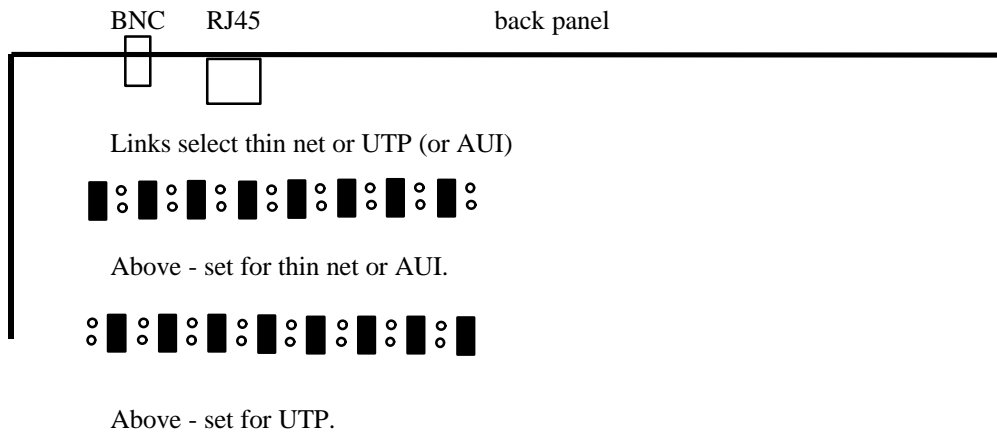


Max load on +5 Vdc output is 100 mA (equal to a load of 50 ohms or more). This is the same internal circuit power used by SFE circuitry. Excessive load will prevent SFE from functioning.

An internal link allows selection of +5V or +12v on pin 6 of the digital output socket.

## Changing Between UTP, ThinNet, AUI port

SFE is shipped with either 1 or 2 Ethernet port interfaces that you choose from three available factory-installed options (see SPECIFICATIONS on page 16). If you ordered units with two network ports, you may switch between them by configuring the set of eight jumpers inside the unit: Disconnect power and remove the top lid by unscrewing the two screws on the rear panel. Locate the eight jumpers directly behind the UTP and coax network connectors, about 3 inches toward the front panel. The eight links are fitted to sixteen sets of link pins in one of two possible forms as shown:

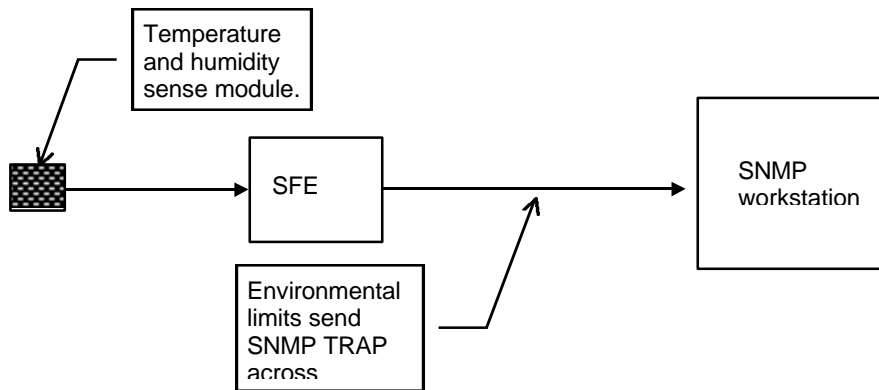


No two jumpers are ever side by side! There is always an unlinked pair of pins between every linked pair.

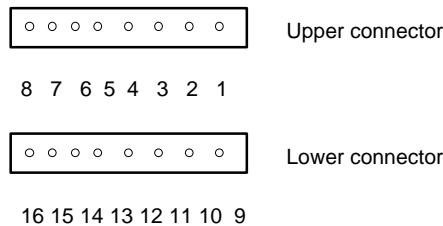
# StarBus for Ethernet

## Temperature and humidity measurement.

Analogue input ports can be specified which are designed to connect to external temperature and humidity modules. Up to four modules can be connected. An SNMP workstation can be used to monitor the temperature and humidity at the remote location. In addition the unit can be configured to send SNMP traps when temperature or humidity inputs exceed set limits. See addendum 1 for more details about the use of SNMP.



## Pin out of the analogue input connectors



Pin assignments -

| Pin no. | Function (upper connector) |
|---------|----------------------------|
| 1       | Relative Humidity input 1  |
| 2       | 0v                         |
| 3       | Temperature input 1        |
| 4       | Power to sensor            |
| 5       | Relative Humidity input 2  |
| 6       | 0v                         |
| 7       | Temperature input 2        |
| 8       | Power to sensor            |

Pin assignments -

| Pin no. | Function (lower connector, if fitted) |
|---------|---------------------------------------|
| 9       | Relative Humidity input 3             |
| 10      | 0v                                    |
| 11      | Temperature input 3                   |
| 12      | Power to sensor                       |
| 13      | Relative Humidity input 4             |
| 14      | 0v                                    |
| 15      | Temperature input 4                   |
| 16      | Power to sensor                       |

4th set normally configured as voltage monitor inputs.

# StarBus for Ethernet

Connect Temperature and humidity sense module(s) to the connectors, carefully noting the pin outs above. The top connector can connect two sense modules and the lower connector can connect one. The last two analogue inputs on the lower connector are reserved.

To calibrate temperature, measure the ambient in the region of the sensor, using an independent thermometer and enter the value read into the SNMP MIB item 'Temperature correction'.

Upper and lower limits can be set on all inputs, and traps will be generated if they are exceeded. A further trap is generated each time the measured input exceeds the limit by a further amount. A return to normal trap is sent when the measured value returns into the normal region.

## **Notes on Using StarBus for Ethernet with Bridges and Routers**

Ethernet bridges learn where the various MAC addresses on your network are and forward packets accordingly. They will normally forward all SFE packets perfectly, but some bridges allow filtering of packets based on certain criteria, for example broadcasts and multicasts can be discarded. If Multicasts are disabled, menu option 3, 'display units on line', will not see units on the far side of the bridge. The same applies to routers and intelligent hubs. They will rarely pass broadcasts or multicasts, so units on the far side of them will not be seen by menu option 3. The SFE protocol is fully TCP/IP compliant, and allows any unit on the WAN to be -

1. PINGed.
2. Linked to any other unit.
3. Have its configuration examined and modified

However, units on different sub-nets of a WAN must be referred to by IP number not name, and valid entries for IP number, default gateway IP number and sub-net mask must be entered into all units. Refer to your network administrator.

## **Use of UDP**

StarBus for Ethernet uses UDP as the data transport and embeds its own protocol within it. SFE uses the UDP source and destination socket numbers of 8500 (unless you have configured the unit to send raw UDP packets).

## **The Keep Alive Heartbeat**

SFE generates a 'heartbeat' packet addressed to itself every 30 seconds or so. This is so that the unit can recover from unexpected lock ups and complements the hardware watchdog circuit. Should the unit not receive any network traffic for a few minutes it will allow the watchdog circuit to reset the unit. *This can affect the unwary user!* If you enter the menu system on a UTP unit that is not plugged into a hub, it will reset itself every few minutes and appear to have 'dropped out of menu mode', because after a reset the unit starts in data mode. Thin-net units can see their own heartbeat packets without being connected to a network.

## **SFE's Effect on Ethernet Traffic**

Apart from the 'heartbeat' packet, SFE only sends network packets when data arrives on its serial or parallel ports. If data arrives slowly, say at typing speed, each character may be sent singly in its own packet. If data arrives faster, many bytes (the factory default is 256) share one packet. Every packet is acknowledged by the receiving unit thus doubling the traffic. Flat out serial data at 38.4 Kbps produces 256 bytes in 64ms which is equal to about 160 data packets and 160 ACK packets per second. This is a very low packet rate compared to most other network devices such as workstations.



# StarBus for Ethernet

- **Addendum 1 — SFE2: SNMP hardware platform**

SFE2 is an advanced hardware platform (it cannot be retrofit onto standard units). It supports SNMP management, IGMP multicasting (e.g. multicast across routers to SFEs locate on a separate subnets), and also remote firmware upgrade.

- SNMP support.
- Local processing - Boolean logic equations.
- TFTP Firmware Upgrade Procedure
- IP Broadcasting and IGMP (supports multicasting to pre-defined group addresses, even across routers)

Also Supports These Additional Hardware Options -

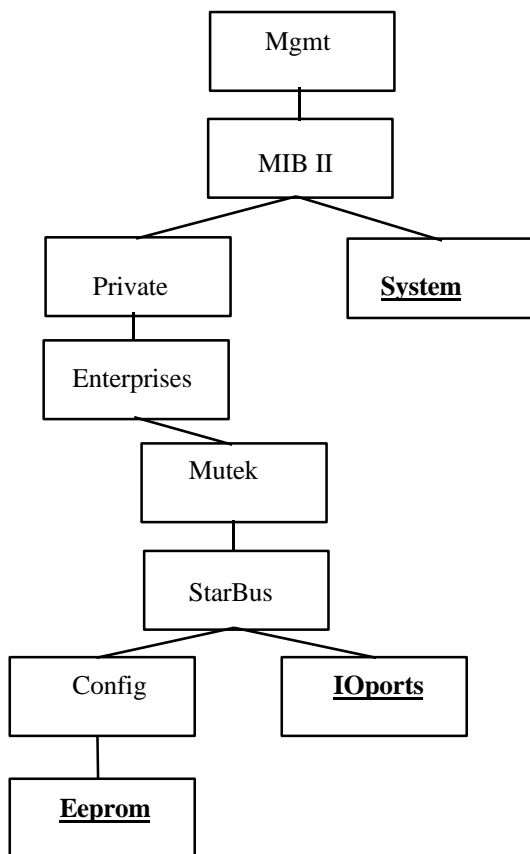
- Expansion Relay I/O option.
- -48Vdc Power Supply Option.

# StarBus for Ethernet

- **SNMP support**

StarBus for Ethernet offers support for Simple Network Management Protocol [SNMP], part of the TCP/IP suite of protocols. Using an SNMP client like HP Open View, administrative users may remotely examine and modify operating parameters of the unit. Additionally, your StarBus for Ethernet may be configured to send SNMP traps for various reasons.

The client software must be configured with the Management Information Base (MIB) supported by the SNMP agent software running in each SFE. The MIB is provided on a DOS diskette in simple ASCII text form ready to be loaded into the management station, and results in a new tree being added under the 'private.enterprises' section of the MIB named 'Mutek'. The portions of the MIB supported by StarBus for Ethernet are diagramed below -



## Setting up to use SFE with SNMP.

1. Whenever using SFE, it is first essential to connect a terminal set to 9600 baud, 8, N, 1, to serial port 2 and use the menu system to enter a unit name and IP numbers. This is explained in the opening section 'Quick Start'. Type ++++ to enter command mode. Use main menu 2 to enter your chosen unit name, IP number, the IP number of the default router, and the sub-net mask and Save these settings.
2. Use an SNMP to set the IP number of the workstation that the unit must send its Traps to. MIB item 'TrapIP' below.

## The Mutek enterprise MIB.

The 'System' part of the MIB shows the seven standard read only variables defined in MIBII.

# StarBus for Ethernet

The 'EEProm' part of the Mutek MIB allows the user to manage the objects shown below.  
Objects relating to the main unit functions -

Macnumber - read-only, the value of the 'burned in' Ethernet number in the unit.  
Name - the unit name  
Password - the unit password (community)  
IPnumber - unit IP number  
RouterIP - the IP number of the default router  
MaskIP - the unit sub-net mask  
SPtrigger - unused  
Sptime, Spchar, SPcount - values to do with when to send packets. Please see section below.  
SerialPort1 - settings for serial port 1, see more below.  
SerialPort2 - settings for serial port 2, see more below.  
ParallelPort - settings for the parallel port, see more below.  
TrapIP - the IP number of the management station that trap messages are sent to.  
IGMPip1 - Multicast group IP number for serial port 1.  
IGMPip2 - Multicast group IP number for serial port 2.

Objects relating to local processing - Boolean logic functions -

andips1 - 32 input bits for AND equation 1.  
andops1 - 8 output bits for AND equation 1.  
andips2 - 32 input bits for AND equation 2.  
andops2 - 8 output bits for AND equation 1.  
orips1 - 32 input bits for OR equation 1.  
orops1 - 8 output bits for OR equation 1.  
orips2 - 32 input bits for OR equation 2.  
orops2 - 8 output bits for OR equation 1.  
inverter - Output bits INVERTER.

Objects relating to analogue sense inputs -

RH-1 - Relative Humidity input no.1.  
Temp1 - Temperature input no. 1  
RH-2 - Relative Humidity input no.2.  
Temp2 - Temperature input no. 2.  
RH-3 - Relative Humidity input no.3.  
Temp3 - Temperature input no. 3.  
15V - 15V supply monitor.  
5V - 5V supply monitor.  
temp-correct - Temperature Calibration.

High and low limits for the analogue inputs. Traps are sent if these are exceeded -

RH1-low - RH-1 low limit.  
RH1-hi - RH-1 high limit.  
Temp1-lo - Temp1 low limit  
Temp1-hi - Temp1 high limit  
RH2-low - RH-2 low limit.  
RH2-hi - RH-2 high limit.  
Temp2-lo - Temp2 low limit  
Temp2-hi - Temp2 high limit

# StarBus for Ethernet

RH3-low - RH-3 low limit.  
RH3-hi - RH-3 high limit.  
Temp3-lo - Temp3 low limit  
Temp3-hi - Temp3 high limit  
15V-lo - 15V supply low limit.  
15V-hi - 15V supply high limit.

Save-button - saves user changes into flash memory.

Serial ports 1 & 2 and the parallel port support the following MIB items -

Name - port name.  
LinkMac - Mac number of the unit this port is linked to. FF = none, 7F = ARP refresh  
LinkPort - Port number on the unit that this port is linked to.  
LinkIP - IP number of the unit that this port is linked to  
TO - idle time out of the above link in 10ms units (eg. 200 = 200 x 10ms = 2 seconds)  
LinkName - text string description of the destination unit that this port is linked to.  
Baud - Baud rate of this port. (serial ports only)  
Format - Number of data bits, stop bits and parity of this port. (serial ports only)  
Flow - flow control method of this port. (serial ports only)  
Multiin - whether this port accepts one link or eight data links. (serial ports only)

The 'IOPorts' part of the Mutek MIB allows the user to manage -

InPort1 - read-only, the value read by onboard contact sense input 1.  
InPort2 - read-only, the value read by onboard contact sense input 2.  
InPort3 - read-only, the value read by onboard contact sense input 3.  
InPort4 - read-only, the value read by onboard contact sense input 4.

OutPort1 - the value being output to onboard relay drive 1.  
OutPort2 - the value being output to onboard relay drive 2.  
OutPort3 - the value being output to onboard relay drive 3.  
OutPort4 - the value being output to onboard relay drive 4.

OutPortA1 - the value being output to expansion option relay 1.  
OutPortA2 - the value being output to expansion option relay 2.  
OutPortA3 - the value being output to expansion option relay 3.  
OutPortA4 - the value being output to expansion option relay 4.  
OutPortA5 - the value being output to expansion option relay 5.  
OutPortA6 - the value being output to expansion option relay 6.  
OutPortA7 - the value being output to expansion option relay 7.  
OutPortA8 - the value being output to expansion option relay 8.

EXP-port1 - read-only, the values read by expansion option contact sense inputs 1 - 8.  
EXP-port2 - read-only, the values read by expansion option contact sense inputs 9 - 16.  
EXP-port3 - read-only, the values read by expansion option contact sense inputs 17 - 24.  
EXP-port4 - read-only, the values read by expansion option contact sense inputs 25 - 32.

## Traps

Traps are generated when certain events occur as described below. The traps are sent to the IP number entered into the variable 'TrapIP'.

# StarBus for Ethernet

## I/O Expansion option Input Port Traps

Input port 1 changes from LOW to HIGH = Trap 1  
Input port 1 changes from HIGH to LOW = Trap 2  
Input port 2 changes from LOW to HIGH = Trap 3  
Input port 2 changes from HIGH to LOW = Trap 4  
Input port 3 changes from LOW to HIGH = Trap 5  
Input port 3 changes from HIGH to LOW = Trap 6  
Input port 4 changes from LOW to HIGH = Trap 7  
Input port 4 changes from HIGH to LOW = Trap 8  
Input port 5 changes from LOW to HIGH = Trap 9  
Input port 5 changes from HIGH to LOW = Trap 10  
Input port 6 changes from LOW to HIGH = Trap 11  
Input port 6 changes from HIGH to LOW = Trap 12  
Input port 7 changes from LOW to HIGH = Trap 13  
Input port 7 changes from HIGH to LOW = Trap 14  
Input port 8 changes from LOW to HIGH = Trap 15  
Input port 8 changes from HIGH to LOW = Trap 16

Input port 9 changes from LOW to HIGH = Trap 17  
Input port 9 changes from HIGH to LOW = Trap 18  
Input port 10 changes from LOW to HIGH = Trap 19  
Input port 10 changes from HIGH to LOW = Trap 20  
Input port 11 changes from LOW to HIGH = Trap 21  
Input port 11 changes from HIGH to LOW = Trap 22  
Input port 12 changes from LOW to HIGH = Trap 23  
Input port 12 changes from HIGH to LOW = Trap 24  
Input port 13 changes from LOW to HIGH = Trap 25  
Input port 13 changes from HIGH to LOW = Trap 26  
Input port 14 changes from LOW to HIGH = Trap 27  
Input port 14 changes from HIGH to LOW = Trap 28  
Input port 15 changes from LOW to HIGH = Trap 29  
Input port 15 changes from HIGH to LOW = Trap 30  
Input port 16 changes from LOW to HIGH = Trap 31  
Input port 16 changes from HIGH to LOW = Trap 32

Input port 17 changes from LOW to HIGH = Trap 33  
Input port 17 changes from HIGH to LOW = Trap 34  
Input port 18 changes from LOW to HIGH = Trap 35  
Input port 18 changes from HIGH to LOW = Trap 36  
Input port 19 changes from LOW to HIGH = Trap 37  
Input port 19 changes from HIGH to LOW = Trap 38  
Input port 20 changes from LOW to HIGH = Trap 39  
Input port 20 changes from HIGH to LOW = Trap 40  
Input port 21 changes from LOW to HIGH = Trap 41  
Input port 21 changes from HIGH to LOW = Trap 42  
Input port 22 changes from LOW to HIGH = Trap 43  
Input port 22 changes from HIGH to LOW = Trap 44  
Input port 23 changes from LOW to HIGH = Trap 45  
Input port 23 changes from HIGH to LOW = Trap 46  
Input port 24 changes from LOW to HIGH = Trap 47  
Input port 24 changes from HIGH to LOW = Trap 48

Input port 25 changes from LOW to HIGH = Trap 49  
Input port 25 changes from HIGH to LOW = Trap 50  
Input port 26 changes from LOW to HIGH = Trap 51  
Input port 26 changes from HIGH to LOW = Trap 52  
Input port 27 changes from LOW to HIGH = Trap 53  
Input port 27 changes from HIGH to LOW = Trap 54  
Input port 28 changes from LOW to HIGH = Trap 55  
Input port 28 changes from HIGH to LOW = Trap 56  
Input port 29 changes from LOW to HIGH = Trap 57  
Input port 29 changes from HIGH to LOW = Trap 58  
Input port 30 changes from LOW to HIGH = Trap 59  
Input port 30 changes from HIGH to LOW = Trap 60  
Input port 31 changes from LOW to HIGH = Trap 61  
Input port 31 changes from HIGH to LOW = Trap 62  
Input port 32 changes from LOW to HIGH = Trap 63  
Input port 32 changes from HIGH to LOW = Trap 64

## 'Onboard Input' Port Traps are generated for changes of the 4 optically isolated inputs -

Onboard Input port 4 changes from HIGH to LOW = Trap 65  
Onboard Input port 4 changes from LOW to HIGH = Trap 66  
Onboard Input port 3 changes from HIGH to LOW = Trap 67  
Onboard Input port 3 changes from LOW to HIGH = Trap 68  
Onboard Input port 2 changes from HIGH to LOW = Trap 69  
Onboard Input port 2 changes from LOW to HIGH = Trap 70  
Onboard Input port 1 changes from HIGH to LOW = Trap 71  
Onboard Input port 1 changes from LOW to HIGH = Trap 72

# StarBus for Ethernet

## SFE front panel push button Traps

This feature is provided as a simple check that traps are operational and being seen by the management station. Note that pressing the push button also takes serial port 2 into command mode. To exit command mode enter ESC to serial port 2 or turn the unit off and on again.

Push button PRESSED = Trap 73

Push button RELEASED = Trap 74

## Analogue input high and low limits traps, and 'return to normal' traps -

RH1 LOW limit = Trap 75

RH1 HIGH limit = Trap 76

RH1 normal = Trap 77

Temp1 LOW limit = Trap 78

Temp1 HIGH limit = Trap 79

Temp1 normal = Trap 80

RH2 LOW limit = Trap 81

RH2 HIGH limit = Trap 82

RH2 normal = Trap 83

Temp2 LOW limit = Trap 84

Temp2 HIGH limit = Trap 85

Temp2 normal = Trap 86

RH3 LOW limit = 87

RH3 HIGH limit = Trap 88

RH3 normal = Trap 89

Temp3 LOW limit = Trap 90

Temp3 HIGH limit = Trap 91

Temp3 normal = Trap 92

15V LOW limit = Trap 93

15V HIGH limit = Trap 94

15V normal = Trap 95

5V LOW limit = Trap 96

5V HIGH limit = Trap 97

5V normal = Trap 98

## END of MIB.

## Examples of using the items in the SFE MIB.

### Making links between SFE ports.

The user must set values in the source port on the source unit of the proposed link. For example, suppose you wish to link port 1 on a certain unit to port 2 on another unit having IP number 1.2.3.4 .

Set SerialPort1 values of the source unit as follows -

LinkMac = 7F xx xx xx xx xx (xx= don't care). Causes ARP cache refresh.

LinkPort = port2

LinkIP = 1.2.3.4

TO = your chosen idle time out to release the destination unit, eg. 200 = 2000msec.

LinkName = 1.2.3.4.

Save-button = Save. This sets up the link and commits it to flash memory.

Note - the proposed destination port must not itself have a link set.

- Local processing - boolean logic equations.

This feature allows StarBus to look at the states of its contact inputs, perform AND and OR logic, and then set or reset its output relays. Two examples -

1. if contact inputs 2 OR 31 are set, then turn on output 1.
2. if contact inputs 12 AND 15 are set, then turn on outputs 3 and 4.



# StarBus for Ethernet

## Code block is corrupted - steps to take.

If the boot block determines that there is a problem with the code block it will not transfer control to it. This is indicated when Serial port 1 Tx and Rx LEDs remain flashing at 1/sec. The write protected boot block holds a program kernel which supports PING and TFTP, so the unit's presence can be checked by Ping and the operational firmware can be sent by TFTP. The code block firmware is provided as a file called HHTFTP.BIN, which is 112k long and has a Fletcher checksum in the last two bytes. The front panel LEDs indicate status as follows -

1. Serial port 1 Tx and Rx LEDs flash 1/sec - boot block is running.
2. LAN Tx and Rx On - boot block is validating the code block. This takes a few seconds.
3. Serial port 1 Tx and Rx LEDs remain flashing 1/sec - checksum failed, boot block still running.
4. Ping the unit to verify operability and the IP number.
5. Send HHTFTP.BIN to the unit using TFTP.
6. Serial port 1 and serial port 2 Tx and Rx LEDs ON - flash being reprogrammed.
7. LAN Tx and Rx On - boot block is validating the newly programmed code block.
8. LEDs adopt normal SFE settings - code is running.

## StarBus is running normally - how to upgrade the firmware.

In the event that a unit is to be upgraded with new firmware, proceed as follows -

1. LEDs are showing normal SFE settings - code is running.
2. Ping the unit to verify operability and the IP number.
3. Send new HHTFTP.BIN to the unit using TFTP.
4. Serial port 1 and serial port 2 Tx and Rx LEDs ON - flash being reprogrammed.
5. LAN Tx and Rx ON - boot block is validating the newly programmed code block.
6. LEDs adopt normal SFE settings - code is running.

## 7. Notes on factory defaults and the TFTP option

With the TFTP upgrade option, all user settings are held in Flash memory, and they can be restored at two levels. The factory defaults are -

|                                       |  |
|---------------------------------------|--|
| IP number - 1.1.1.44                  | Serial ports - 9600 baud, 8, N, 1, Xon/.Xoff, input port                                 |
| Default gateway IP number - 1.1.1.100 | Parallel port - Centronics output  |
| Sub-net mask - 255.255.255.0          | Trigger character to enter command mode is +   |
| Password - pass                       | Embedded code arming string is off.  |
| Name - HitchHiker                     | Network packets - 256 bytes long, sent when 100ms elapses since last received character. |

## 'Very Cold start' - factory use to initialize user settings.

At the factory the boot kernel is made to copy the default settings from itself (read only) into both the 'Cold' and 'Warm' parameter blocks, by setting dip switch 6 to ON. This also prevents the unit from running normal StarBus code, so switch DIP switch 6 off a few seconds after power up -

1. Turn DIP switch 6 ON
2. Power the unit ON
3. SFE kernel does Very Cold start - wait a few seconds and turn DIP switch 6 OFF



# StarBus for Ethernet

4. Ping the unit to verify operability and the IP number.
5. Send HHTFTP.BIN to the unit using TFTP.
6. Serial port 1 and serial port 2 Tx and Rx LEDs ON - flash being re-programmed.
7. LAN Tx and Rx On - boot block is validating the newly programmed code block.
8. LEDs adopt normal SFE settings - code is running.
9. Now perform a normal 'Cold Start' as described below -

'COLD START' - user reinitializes default settings.

At any time the user can copy the Cold settings into the Warm settings by setting dip switch 3 to ON. (IMPORTANT: *On SFE boxes with no switch access on the rear panel, look inside for a blue 4-position DIP switch. In this case, use switch 4).*

1. Turn DIP switch 3 ON
2. Power the unit ON - Serial port 1 Tx and Rx leds flash 1/sec - boot block is running.
3. LAN Tx and Rx ON - boot block is validating the code block. This takes a few seconds.
4. SFE does Cold start and Leds adopt normal SFE settings - code is running.
5. Turn DIP switch 3 OFF

Memory map of SFE2 (the SNMP-version of StarBus, with FlashROM upgrade capability):

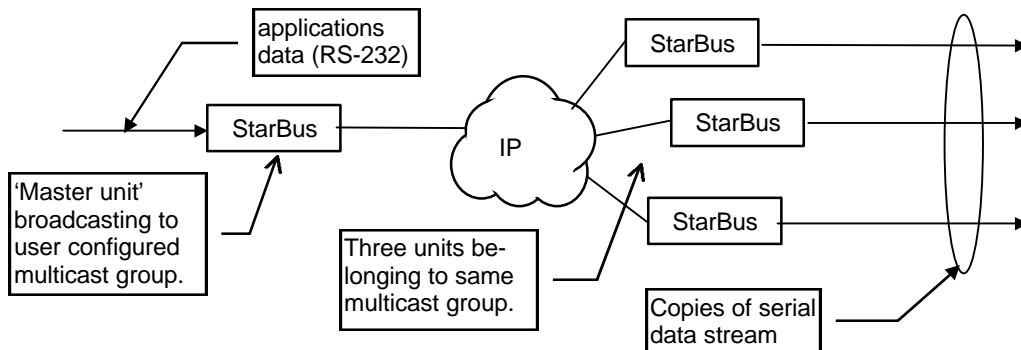
|                  |            |   |
|------------------|------------|---|
| Top of memory    | 128k Flash | 8k write protected Boot block, holds the program kernel |
|                  |            | 4k 'warm' parameter block for user settings             |
|                  |            | 4k 'cold' parameter block for default user settings     |
|                  |            | 112k main SFE program block                             |
|                  |            |   |
|                  | Unused     | 384k  |
|                  |            |   |
| Bottom of memory | RAM        | 128k  |

# StarBus for Ethernet

## **Broadcasts across Routers (only on SFE2 w/SNMP, FlashROM and IGMP)**

StarBus for Ethernet has always provided Ethernet multicasts. Now SFE2 with SNMP management and internal FlashROM supports IP multicasting and full IGMP level 2. This means that you can broadcast to devices anywhere on your WAN. Each of the two serial ports on any SFE can be set to broadcast to its own broadcast group.

The IGMP/Multicast feature may be initialized either via the MIB database (which is loaded onto the SNMP server), or directly from the configuration menus on any SFE2 (menu initialize option added with SFE2 version 1.53e).



IP broadcasting relies on using a special range of IP numbers, reserved by the IP numbering committee (IANA), in the range 224.0.0.0 to 239.255.255.255. These IP numbers correspond to a block of Ethernet (MAC) addresses in the range 00:00:5e:00:00:00 to 00:00:5e:7f:ff:ff. The StarBus menu system checks for this range of IP addresses and performs the necessary translation to Ethernet addresses.

IP broadcasting also relies on the network routers to perform IGMP (internet group management protocol) in order to discover devices that belong to IP broadcast groups. It does this by sending IGMP queries and receiving the IGMP responses from these devices, reporting their group membership. StarBus may be configured to join broadcast groups (described below), and will then respond to router IGMP requests appropriately.

HitchHiker configuration can be performed using the menu system or SNMP, as described below.

### Configuration for IP Broadcast using HitchHiker Menus.

For example, to set serial port 1 on a master unit to broadcast to a group of units on the broadcast IP number 224.1.2.3, proceed as follows -

Setting up the broadcasting unit -

- Use the main menu item **1 - Set up Link**, entering the IP number of the master unit and its password.
- Enter the port number which is to broadcast, 1 in this example.
- Enter the example broadcast IP number, 224.1.2.3, as the name of the destination unit.
- Choose an idle time out or press enter to accept the 20sec default.
- Press S to save these settings.

Notes -

- Valid IP numbers for IP multicast groups are in the range 224.0.0.0 to 239.255.255.255, so when you enter a number in this range as the 'destination unit', HitchHiker automatically sets itself up to perform IP broadcasting.
- the broadcasting unit does not need to join the broadcast group (see next page).

# StarBus for Ethernet

Setting up units to join the broadcast group -

- Use Main Menu **2 - Configure Unit**. Enter the IP number of the unit and its password.
- Enter the port number which is to join the broadcast group, 1 or 2 (the parallel port cannot be used).
- Use sub-menu **6 - Rename Port** and enter the example broadcast group IP number as follows; IGMP 224.1.2.3 (one space between the letters IGMP and the IP number).
- Press S to save these settings.

Perform the steps above on each unit/port which you wish to receive data broadcast by the master.

Notes -

- the port name now appears as IGMP, but if the unit configuration is examined (Main Menu 2), it can be seen that the port reports itself as - named IGMP group 224.1.2.3 - destination port.
- Ports that you join to IP broadcast groups should not themselves have links set.
- data arriving at a port which has joined a broadcast group will automatically be sent back to the master unit, provided that it has received data from the master unit.

## Configuration for IP Broadcast using SNMP.

For example, to set serial port 1 on a master unit to broadcast to a group of units on the broadcast IP number 224.1.2.3, proceed as follows -

On the master unit -

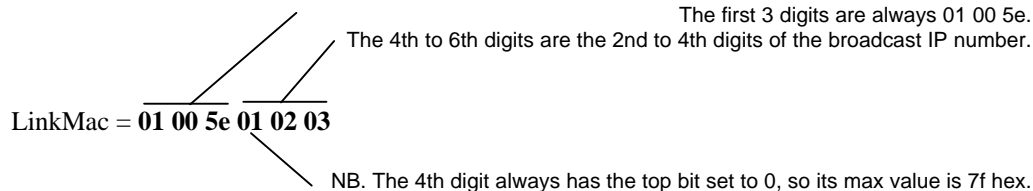
1. Using your SNMP workstation enter the IP broadcast group number 224.1.2.3 into the OID for serial port 1. The OIDS 'IGMPip1' and 'IGMPip2' correspond to serial ports 1 and 2 respectively.
2. Set the remaining SerialPort1 values as follows -

LinkMac = 01 00 5e 01 02 03\*

LinkIP = 224.1.2.3

LinkName = '224.1.2.3'

\*The LinkMac number is composed as follows -



3. Save-button = Save the settings above. This sets up the link and commits it to flash memory.

On the receiving units -

1. Using your SNMP workstation enter the IP broadcast group number 224.1.2.3 into the OID IGMPip1 or 2, depending on which serial port you wish to receive the broadcasts.
2. Save-button = Save the settings above.

Notes:- the destination ports on the receiving units must not themselves have links set.

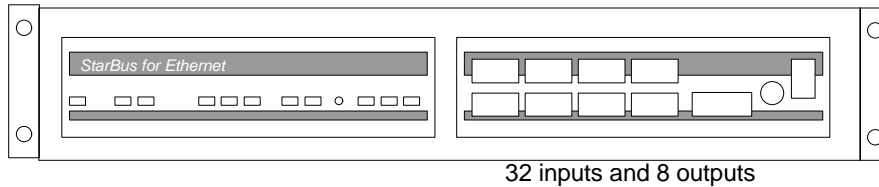
- Valid IP numbers for IP multicast groups are in the range 224.0.0.0 to 239.255.255.255.

# StarBus for Ethernet

## Hardware options -

- The expansion relay I/O option.

This option is provided in a 19" rack mount case approximately twice as wide as the standard unit. The extra inputs and outputs are mounted in the RHS of the unit (as viewed from the front) and feature indicator LEDs and lamp test button on the front panel and two-part connectors on the back panel.

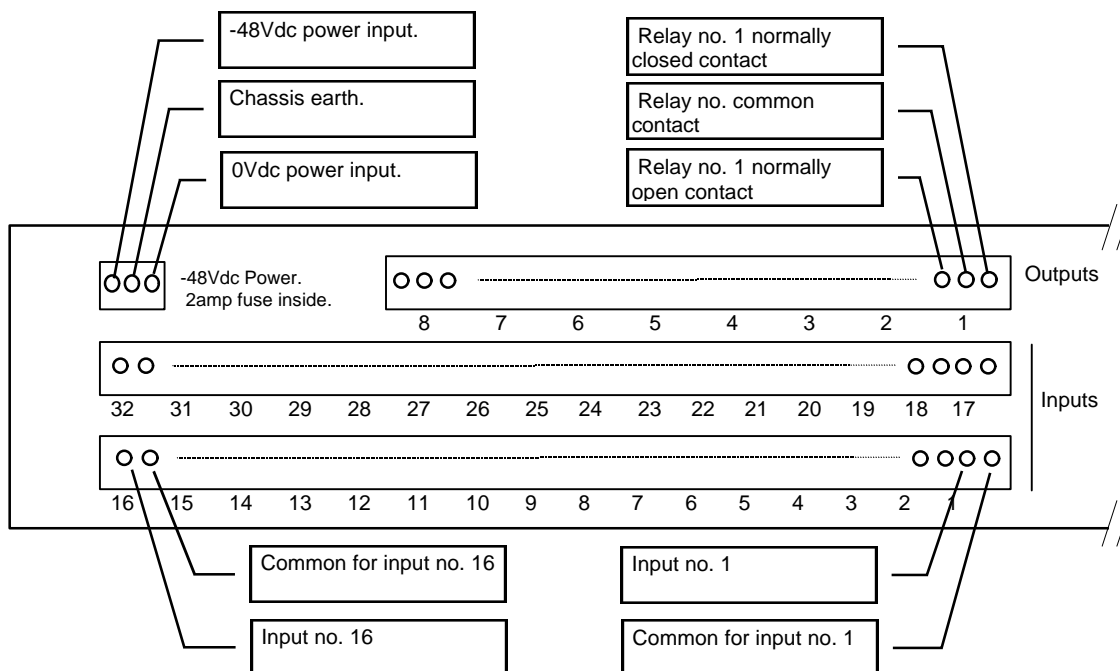


This option provides -

1. Up to 32 contact sense inputs suitable for connection of a volt free switch or relay contact.
2. Up to 8 miniature relays, each presenting a normally closed, normally open and common contact.
3. An indicator panel that shows the states of the contact sense inputs and the relay outputs. This panel has 32 LEDs that indicate the states of the 32 contact sense inputs. Associated with the LEDs are 32 dip switches which allow the user to select whether an LED is ON for a closed or open contact. The panel also has 8 LEDs which indicate the current state of the 8 relays. ON means that the common and normally open contacts are connected. In addition, there is a lamp test push button and an ON/OFF power switch.
4. Supported by the optional SNMP software module.

## Pin out of the rear panel connectors for the expansion relay I/O option (48Vdc power option shown).

There are three rows of (5.08mm pitch) two part screw connector sockets on the rear panel to terminate the 32 contact inputs and (up to) eight relay outputs. There is also a (3mm pitch) two part screw connector used to terminate -48Vdc power to the unit. The bottom row of connectors carries contact inputs 1 - 16, the middle row carries contact inputs 17 - 32, and the top row carries the relay contacts.

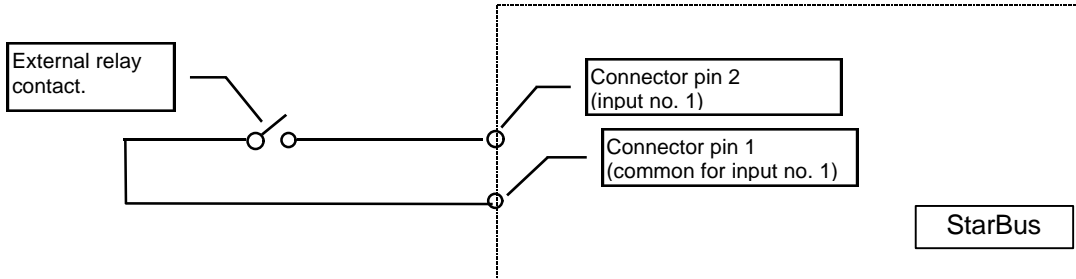


# StarBus for Ethernet

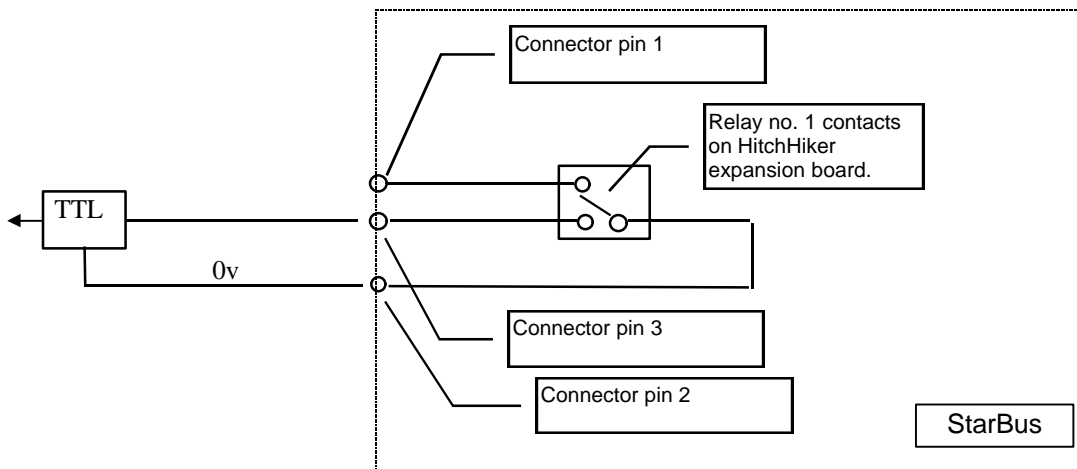
As shown, the inputs are arranged as a pair of pins for each contact input, one pin being signal ground and the other being the contact input as shown above. Note that the contact inputs number from right to left. The outputs are arranged as three pins per relay - normally closed, common and normally open contacts from right to left for a total of 24 pins.

## Example usage of the relay expansion option.

How to drive the contact sense inputs from a 'voltage free dry contact' e.g. switch or relay contact -

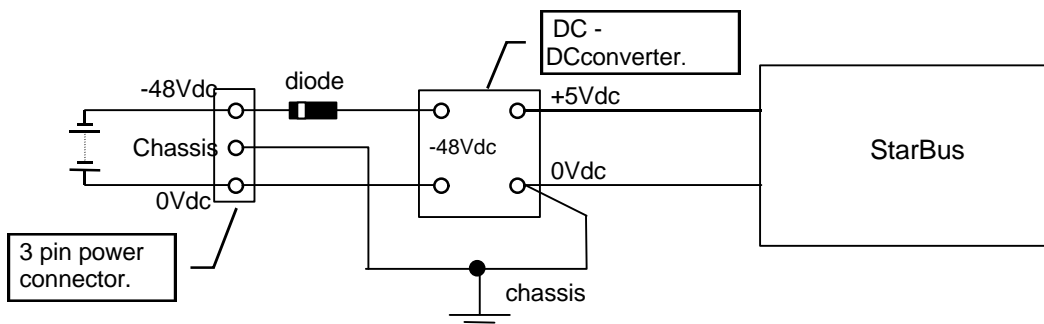


How to use the relay output contacts to drive a TTL gate input -



- -48Vdc power supply option.

The expanded I/O StarBus can be ordered for use on a -48Vdc battery supply. The internal arrangement of the power supply circuitry is shown below -



# StarBus for Ethernet

## **Addendum 2 – StarBus for Ethernet Protocol**

SFE supports members of the TCP/IP suit of protocols, namely IP, ARP, ICMP, SNMP and UDP. It will also respond to a Ping (ICMP). StarBus uses UDP transport exclusively, and its own protocol and the transported data is carried inside UDP datagrams. The data carried is 1 byte minimum (after time out) and 256 bytes maximum. The Ethernet encapsulation is as defined in RFC 894 and mandated by RFC 1022. The packet format is shown below -

Mac Header -

- 6 bytes Destination MAC address
- 6 bytes Source MAC address
- 2 bytes Type - 0800 for IP packets, 0805 for ARP requests and 0806 for ARP replies.

IP header -

- 2 bytes IP Version - 4, header length - 20, TOS - 16 (4510h)
- 2 bytes IP packet length including header
- 2 bytes identifier (packet number, unique over a short period)
- 2 bytes fragmentation - 00
- 2 bytes TTL - 64, protocol - 17= UDP (4011h)
- 2 bytes header checksum
- 4 bytes Source IP number
- 4 bytes Destination IP number

The UDP fields contain either - 1) Normal SFE mode

UDP header -

- 2 bytes Source port - 8500 (2134h)
- 2 bytes Destination port - 8500 (2134h)
- 2 bytes length of UDP portion including header
- 2 bytes optional UDP checksum - set to 00.

SFE header -

- 2 bytes spare
- 2 bytes byte 1 - 34h or 0b4h, byte 2 - 32h. SFE ID code.
- 1 byte Command(1)= 0000cccc where cccc is decoded as -
  - 01 - ACK
  - 02 - Start link
  - 03 - Multicast - who is there?
  - 04 - Multicast reply
  - 05 - Command packet
    - Sequence # bits re-used as -
    - 01 - enquiry; send configuration
    - 02 - reply to enquiry
    - 03 - new configuration data to be adopted
  - 07 - heartbeat (unicast to own Mac)
  - 08 - Data packet
- 1 byte Command(2)= ddss0nnn -
  - where dd= destination port # and ss= source port #, range 0 - 2,
  - and where nnn= packet sequence number; range 0 - 7.

StarBus for Ethernet data: 1- 256 bytes - May be user data or protocol data, as defined above.

Or 2) If 'raw UDP packets' are chosen: UDP header -

- 2 bytes Source port - 6000 (serial port 1) or 6001 (serial port 2)
- 2 bytes Destination port - user selected
- 2 bytes length of UDP portion including header
- 2 bytes optional UDP checksum - set to 00.

UDP data -

- 0- 256 bytes - user data.

# StarBus for Ethernet

## **Addendum 3 — SFE Menu Tree**

### Section 1...

To enter the SFE menu - 1) Press the front panel push button, or 2) Type ++++ into port 2, or if an arming string has been set, send {AS}N to port 2, where {AS} represents your chosen application sequence.

SFE (or HITCHHIKER) - ROOT MENU

- 1 - Set up Link
- 2 - Configure Unit
- 3 - Display units on line
- 4 - Print units on line
- 5 - Display statistics
- S - Save settings
- ESC Quit without save

#### 1. Set up Link

- Enter name of Source Unit - Name - HITCHHIKER
- Enter Password for Unit - Password - \*\*\*\* (default= pass)
- Enter source Port number - 2 (choose 1,2,3 or 4)
- Enter name of Destination Unit - Name - (enter name, IP no. or 'None' to remove link, or 'Multi' to broadcast, or 'UDP IPno UDPsktno' to send raw UDP packets) - Checking units on line
- Select Destination Port of Link - 1 (choose 1,2,3,4.)
- Select Time-out for Destination Port of Link - 2 (choose 50ms, 2 sec, 20 sec, 2 min or never.)
- S - Save settings
- ESC Quit without save

#### 2. CONFIGURE UNIT HITCHHIKER. Go to section 2 for sub menus → Section 2

- 1 - Configure serial port 1 - named port1
- 2 - Configure serial port 2 - named port2
- 3 - Configure parallel port - named port3
- 4 - Configure Digital I/O port - not linked
- 5 - Rename Unit
- 6 - Change Password
- 7 - Change IP numbers
- 8 - Change when to send packet parameters
- 9 - Reset to Factory Defaults
- A - Change arming string
- S - Save settings
- P - Return to previous menu
- ESC - ROOT MENU

#### 3. List of all units on line

LOCAL Unit name → HITCHHIKER MAC 00201D000428 IP 0.0.0.0 V1.31

Port name → port1 is a destination port

Port name → port2 is a destination port

Port name → port3 is a destination port

Port name → port4 is a destination port

Press space to continue when list is complete

| Unit Name | Ser1 name | Ser2 name | Par name | MAC number | Version           |
|-----------|-----------|-----------|----------|------------|-------------------|
| BOB       | port1     |           | port2    | port3      | 00201D000439 1.31 |
| 386       | port1     |           | port2    | port3      | 0040332D9B2B 2.00 |

# StarBus for Ethernet

4. As above, sent to the parallel output port.
5. StarBus for Ethernet Statistics -  
Shows total Packets sent and received, and by packet type - data, ack, link, multi, info, query, reply and config.

## Section 2...

From section 1 → Configure Unit sub menus.

- 1 - Configure serial port 1 - named port1
- 2 - Configure serial port 2 - named port2
- 3 - Configure parallel port - named port3
- 4 - Configure Digital I/O port - not linked
- 5 - Rename Unit
- 6 - Change Password
- 7 - Change IP numbers
- 8 - Change when to send packet parameters
- 9 - Reset to Factory Defaults
- A - Change arming string
- S - Save settings ← return here to save ← @
- P - Return to previous menu
- ESC - ROOT MENU

### 1. and 2. PORT HARDWARE CONFIGURE

Port named port1/2 is set-up for Xon/Xoff controlled input

9600 Baud No Parity 1 Stop bits and 8 Data bits

- 1 - Baud
- 2 - Stop
- 3 - Parity
- 4 - Data bits → Selections 1 to 7 sub menus in section 3 →
- 5 - Handshake
- 6 - Rename Port
- 7 - 8 channel receiver
- 8 - Output delays
- S - Save settings, P - Previous Menu, ESC Root Menu

### 3. PARALLEL PORT CONFIGURATION

Parallel port named port3 is configured for Centronics Input

- 1 - Set as CENTRONICS OUTPUT
- 2 - Set as CENTRONICS INPUT
- 3 - Set as DATA PRODUCTS INPUT
- 4 - Set as DATA PRODUCTS OUTPUT
- 5 - Rename port
- S - Save settings, P - Previous Menu, ESC Root Menu



# StarBus for Ethernet

4. Configure Digital I/O port -

|                                    |      |      |      |      |
|------------------------------------|------|------|------|------|
|                                    | Pin1 | Pin2 | Pin3 | Pin4 |
| Last recorded state of input lines | HIGH | HIGH | HIGH | HIGH |
| Last recorded state of output pins | LOW  | LOW  | LOW  | LOW  |

  - 1 - Set output pin 1
  - 2 - Set output pin 2
  - 3 - Set output pin 3
  - 4 - Set output pin 4
  - U - Update unit - save changes and re-read inputs
  - P - Previous Menu, ESC Root Menu
  
5. Enter new unit name - ?  $\longrightarrow$  return to @ to save
  
6. Enter new pass word for unit HITCHHIKER  
New password - ?  $\longrightarrow$  return to @ to save
  
7. Change IP numbers
  - The units IP number is 0.0.0.0
  - The default gateway IP number is 0.0.0.0
  - The subnet mask is 0.0.0.0
  - 1 - Change IP number
  - 2 - Change Router IP number
  - 3 - Change Local Net Mask  $\longrightarrow$  return to @ to save
  
8. Change when to send a packet parameters
  - Current time-out is 10
  - Current maximum packet size is 256
  - 1- Change time out from last packet sent - 1 - 127ms. 0=feature off
  - 1 - Change time-out from last character received - 10msec units 1-127. 0=feature off
  - 2 - Change Size of pkt to send - Max packet size (1-256) - ?
  - S - Save settings, P - Previous Menu
  
9. RESET TO FACTORY DEFAULTS
  - 1 - Confirm reset unit HITCHHIKER to Factory defaults(inc. password)
  - P - Previous Menu, ESC Root Menu  $\longrightarrow$  return to @ to save
  
- A. Change Arming string
  - Current string is - none
  - 1 - Change string
  - S- Save settings, P - Previous menu, ESC Root Menu.

## Section 3...

From section 2  $\longrightarrow$  1 - Configure serial ports 1 and 2, sub-menus -

- 1 - Baud
- 2 - Stop
- 3 - Parity
- 4 - Data bits
- 5 - Handshake
- 6 - Rename Port
- 7 - 8 channel receiver
- 8 - Output delays

# StarBus for Ethernet

## 1. SELECT BAUD RATE

- 0 - 38k4
- 1 - 19k2
- 2 - 9600
- 3 - 4800
- 4 - 2400
- 5 - 1200
- 6 - 600
- 7 - 300
- 8 - 150
- 9 - 110

## 2. SELECT STOP BITS

- 1 - 1 stop bit
- 2 - 2 stop bits

## 3. SELECT PARITY

- 1 - NONE
- 2 - 0 Parity
- 3 - ODD
- 4 - EVEN

## 4. SELECT DATABITS

- 1 - 7 bits
- 2 - 8 bits

## 5. SELECT HANDSHAKE

- 1 - Hardware
- 2 - Input generating Xon/Xoff
- 3 - Output responding to Xon/Xoff
- 4 - Bi-directional Xon/Xoff
- 4 - DTR/DSR direct end to end (plus one of above)
- 5 - Turn off end to end direct

## 6. Current name is port1

New Name - David

## 7. Port named port2 is set-up for Xon/Xoff controlled input

8 port receiver mode ON.

9600 Baud No Parity 1 Stop bits and 8 Data bits

## 8. Change output delays

Current character delay is 0msec

1. Change character delay

S- Save settings, P - Previous menu, ESC Root Menu.

# Upgrading the Feature Chip

## Upgrading the *StarBus for Ethernet* Feature Chip

From time to time, new firmware chips are released which may contain features that enhance your specific application. This page describes the process of upgrading your StarBus for Ethernet. If a similar page is included with your feature chips, use it and not this one, since it may contain breaking news which supersedes these instructions.

1. **OPEN HOUSING:** First disconnect power! Locate either two screws at rear and remove top lid – or on cases with no top lid, remove the the small recessed screws beneath each rear foot and slide the entire circuit board out the back end.
2. **REMOVE OLD CHIP:** The feature chip is a 14-pin ROM labeled with a software version and unique MAC address. Observe orientation of the notch, which faces the back of the unit ...

Insert a miniature flat-blade screwdriver nearly flush with the socket and rotate slightly (a little at a time – from each end). Keep it level as it rises to avoid bending pins. Align the new chip over the socket and verify orientation of the notch. It is not necessarily oriented with the writing on the label! Verify that all pins enter socket together.

**IMPORTANT:** You *must* return old feature chip so that we can reissue its unique MAC number. Without return, you will be billed \$15 – *even during the warranty period!* There are no exceptions to this policy.


4. **LABEL UNIT:** Before proceeding, write the version and MAC number of the *new* chip on the bottom of the unit.
5. **MASTER RESET:** **Style-A:** Locate blue dip switch. Set switch #4 ON (cold reset); apply power; wait 10 seconds for LED sequence. **Style-B:** This model has switches accessible from the back (includes all units with SNMP/TFTP/IGMP features). Set switch #3 down (ON) to reset. Then power down and slide back up. LED's should indicate:

|       |   |
|-------|---|
| POWER | RED or GREEN according to installed LAN port option |
| C/D   | GREEN (all other LEDs should be off)                |
6. **SOFTWARE RESET:** a) Remove power; turn switch #4 OFF; Close & fasten screws. b) Awaken at 9600 bps ('++++'); Select menu 2: CONFIGURE (Name = HITCHHIKER, Password = 'pass'); Then menu 9: RESET FACTORY DEFAULTS.

Review any enclosed documentation about your new features, which may include specific examples of their use. Don't forget to return your old chips promptly, to avoid being billed for a dual MAC registration!

### Problems

- a) The LEDs do not finally stabilize as expected:
  - Disconnect power. Remove new feature chip. Check orientation and for bent pins underneath.
  - Did you remember to set the COLD RESET switch to ON? It causes a 'cold start' load of all configurable settings.
  - Try again. If problem persists, try the old chip again to see if it is OK.
- b) You change and save settings (NAME, BAUD RATE, etc), but old settings return at next power on.
  - Did you remember to return the COLD RESET switch to OFF? If not, unit will reload factory default settings.

 Your new chip may have a new MAC address. If you have been using \$MACNO addressing to make links, you must remake the links using the new MAC numbers.

