PANEL-LINK INTELLIGENT HUB (I-HUB) USER'S MANUAL

DOCUMENT: LT0229

Issue 2.05, 11 November 2020

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The company therefore cannot accept any responsibility as to the suitability of the functions generated by the user using the configuration facility.

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AMENDMENT LIST

Issue 1.00	20 September 1999	Original
Issue 1.01	29 September 1999	Minor Corrections to Section 2.3
Issue 1.02	12 May 2000	Correct link errors in Section 3.7.
Issue 1.30	14 September 2004	Complete revision.
Issue 1.31	29 September 2004	Sections 3.3.5 and 3.4.4 add ADAM information.
Issue 1.32	4 March 2006	Section 2.3. Add IC0358 may be needed for F3200. Section 3.3.3. Revised completely. Figure 3.3.6. Add 0V connection. Add Fig 3.3.9 and text. Section 4.2.3.2 add App 6 to list. Section 5.6.2. Fix SENDMAFST.
Issue 2.00	31 October 2013	Complete revision for V2.00 I-HUB firmware.
Issue 2.01	19 December 2013	Changed in Section 1.4 recommended dual path link setup to link two ring networks. Noted in Section 3.3.1 that 9600 baud rate limits the number of panels. Noted in Section 3.3.2 that allowed optical loss must include causes of optical degradation. Removed all descriptions of PA0880 solutions. No longer state CONCATMSG should be disabled for point-to-point mode. Better describe what each MAF status is caused by. Minor corrections.
Issue 2.02	28 April 2014	Added documentation for fault output functionality introduced in firmware V2.02.
Issue 2.03	26 May 2015	Added section 5.7.4.7. Changed some tables to have LEARNSIDS enabled.
Issue 2.04	5 December 2016	Update for I-HUB V2.04 firmware with new quick configuration commands. Update for MX1 V1.70 firmware which allows MX1 to interact with AS4428 devices. Include database templates for various configurations.
Issue 2.05	11 November 2020	Added QE20 data.

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1 INTRODUCTION

1.1 I-HUB DESCRIPTION

The VIGILANT Panel-Link Intelligent Hub (I-HUB) is part of the family of products that connects onto the VIGILANT Panel-Link network. The I-HUB performs bridging and routing functions for the Panel-Link networks and Panel-Link devices.

Deploying an I-HUB in a ring network configuration can add extra levels of redundancy and service protection to multi-drop Panel-Link networks. The I-HUB supports ring, multi-drop and point-to-point networks.

The I-HUB can also be introduced into large networks to assist in reducing network congestion by use of its filtering and 'routing' capabilities.

For simple ring networks utilising *MX1* fire panels, the factory configuration allows 'plug and play' operation with no custom configuration required. Where the factory configuration is not suitable, SID learning and other functionality introduced with V2.00 firmware reduces the amount of custom configuration required.

The I-HUB has five network ports, one of which is used as the I-HUB programming port. Each network port can be connected to a network of devices or to a single device. Panel-Link messages received on one port can be routed to any or all of the other ports. This allows the physical size of a Panel-Link system to be extended, or multiple Panel-Link networks to be joined together, and also allows devices on different physical media to be connected. For example, one port on the I-HUB could be a 2400 baud modem on a leased line to a remote FIP, another port could be a 9600 baud TTL connection to a FIP, and a third port could be a 9600 baud multi-drop link to a series of FIPs.

Two of the I-HUB ports are 2 or 4 wire RS485 connections that usually operate in tandem as a duplicated channel, or can be configured as part of a ring network (they cannot be configured to operate independently). A further two ports provide RS232 levels. If required, these may be connected to a variety of external interface boards that convert RS232 levels to RS485, or to modems.

A fifth port is a TTL level serial port that can be connected to a FIP TTL port, an RS485 board, or a CMOS/TTL to RS232 interface board to give an RS232 output.

1.2 ORGANISATION OF THIS MANUAL

This document is divided into several sections.

Section 1 introduces possible applications of the I-HUB along with numbering of the physical ports of the I-HUB.

Section 2 details the technical specifications of the I-HUB, along with the part/order codes of available accessories.

Section 3 covers the mounting and wiring of the I-HUB.

Section 4 introduces I-HUB network concepts and describes some specific network configurations for particular situations. These may be of some assistance in determining which of the four I-HUB network ports should be used, and in what mode, for a particular application.

Section 5 details the programming commands.

Section 6 describes how to use the diagnostic facilities of the I-HUB.

Section 7 introduces the network programming and setup for VIGILANT fire panels for use with the I-HUB.

Important notes to consider when configuring or deploying the I-HUB are contained within shaded boxes, like the one below:

A note of particular importance during setup and configuration.

1.3 I-HUB PORT NUMBERING

Figure 1.2.1 shows the port numbering detail for the I-HUB. Note that the port numbers are not the same as the component overlay connector numbers.

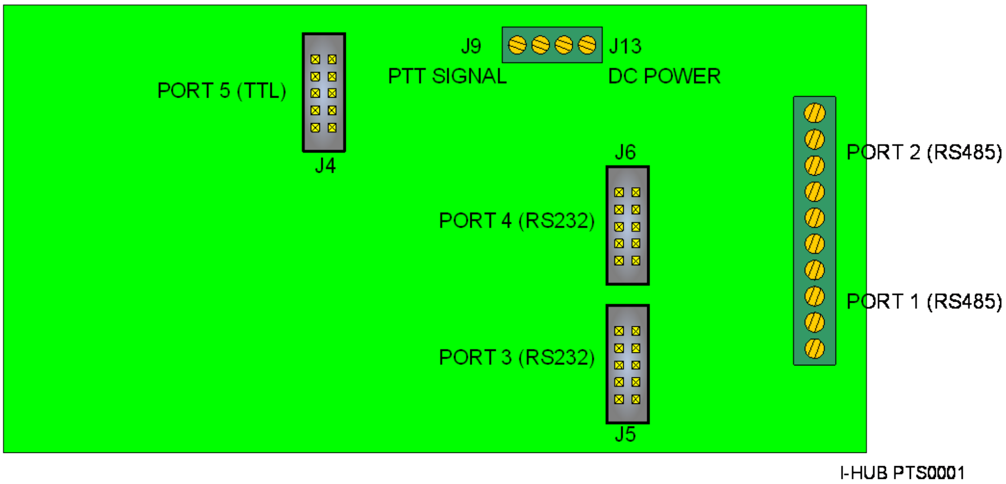

Figure 1.2.1 – Major Connector Numbering

Never plug/unplug cables into/out of the I-HUB’s connectors whilst the I-HUB is powered on. This can permanently damage the I-HUB.

Take extreme care not to plug TTL, RS232, and QE90 communication cables into the wrong connectors. This can permanently damage the I-HUB.

1.4 I-HUB APPLICATIONS

The I-HUB can be used in a number of different applications. The following diagrams illustrate some of the possible I-HUB uses. Please note that these are a small overview of what can be achieved using the I-HUB and do not represent detailed implementations.

This document refers to ‘duplicated channel’ operation in many places, which is a requirement of most fire installation standards. Refer to the appropriate standard, AS 1670.1 for Australia, NZS 4512 for New Zealand.

The I-HUB can provide duplicated channel operation via Ring networking or the original dual bus multi-drop wiring.

The “RING” method shown in Figure 1.3.1 provides a level of redundancy not found in other kinds of network topology. The ‘ring’ configuration, with the I-HUB incorporated in each panel, is the recommended topology for new installations.

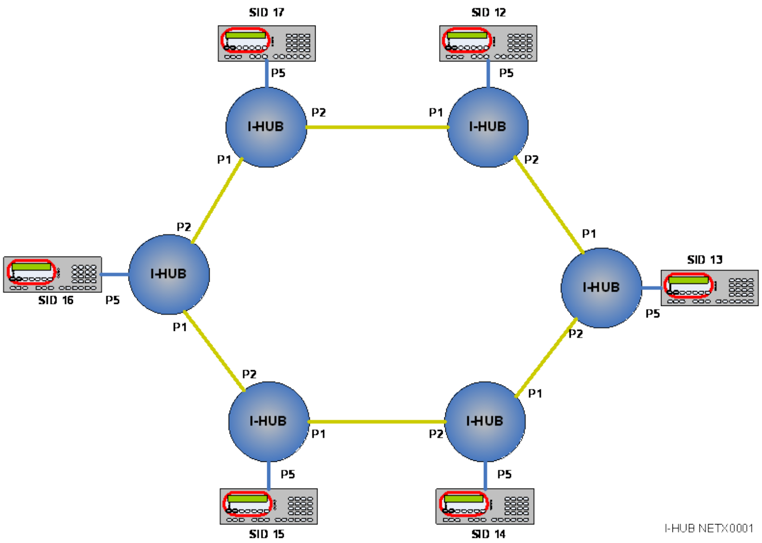

Figure 1.3.1 – Network Ring Example

The dual bus wiring arrangement shown in Figure 1.3.2 uses the two RS485 ports of the I-HUB to transmit and receive messages on two parallel paths, usually wired in diverse routes to avoid a single cable break affecting both paths. This provides one level of redundancy, in that a fault on one bus can be tolerated with the other bus still working.

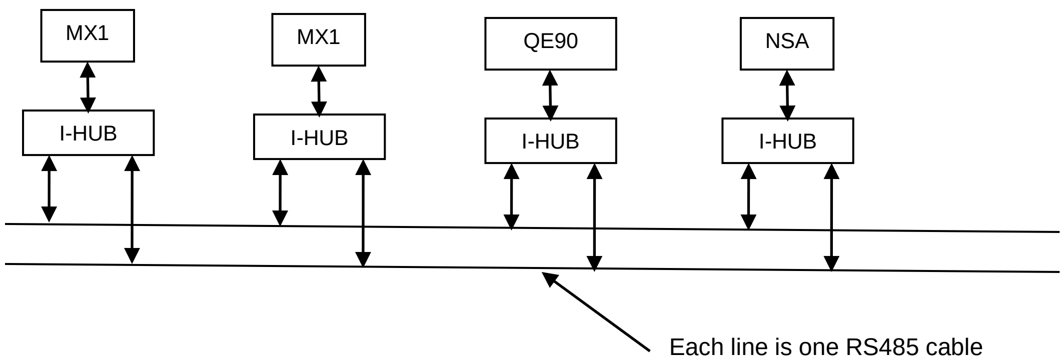

Figure 1.3.2 – Dual Bus Arrangement

The I-HUB can be used to connect two to four Panel-Link networks together to allow a greater physical length as shown in Figure 1.3.3.

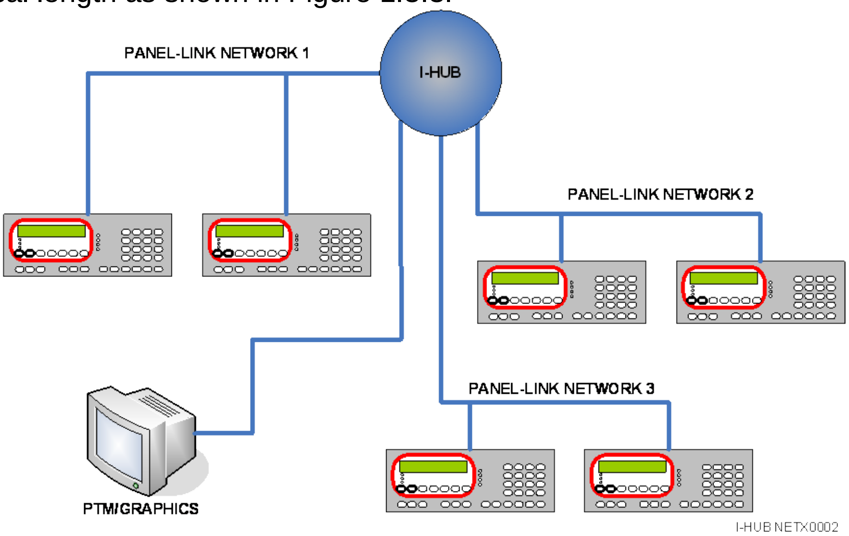

Figure 1.3.3 – Joining Multiple Networks Together

The I-HUB can be used in MX1 panels to allow these to be on the same network as QE20 Evacuations Systems, and optionally for the MX1 to send fire alarm information to and receive fault status from the QE20 panels. Ring networking must be used, as the QE20 does not support dual bus or single channels. This general arrangement is shown in Figure 1.3.4. An I-HUB is not fitted to the QE20 as the QE20 uses its own RS485 Network Module. Note however, the I-HUB does not support the QE20 Synch Clock message. So if synchronisation of tones and messages between QE20 panels on the network is required, then I-HUBs cannot be included on the ring.

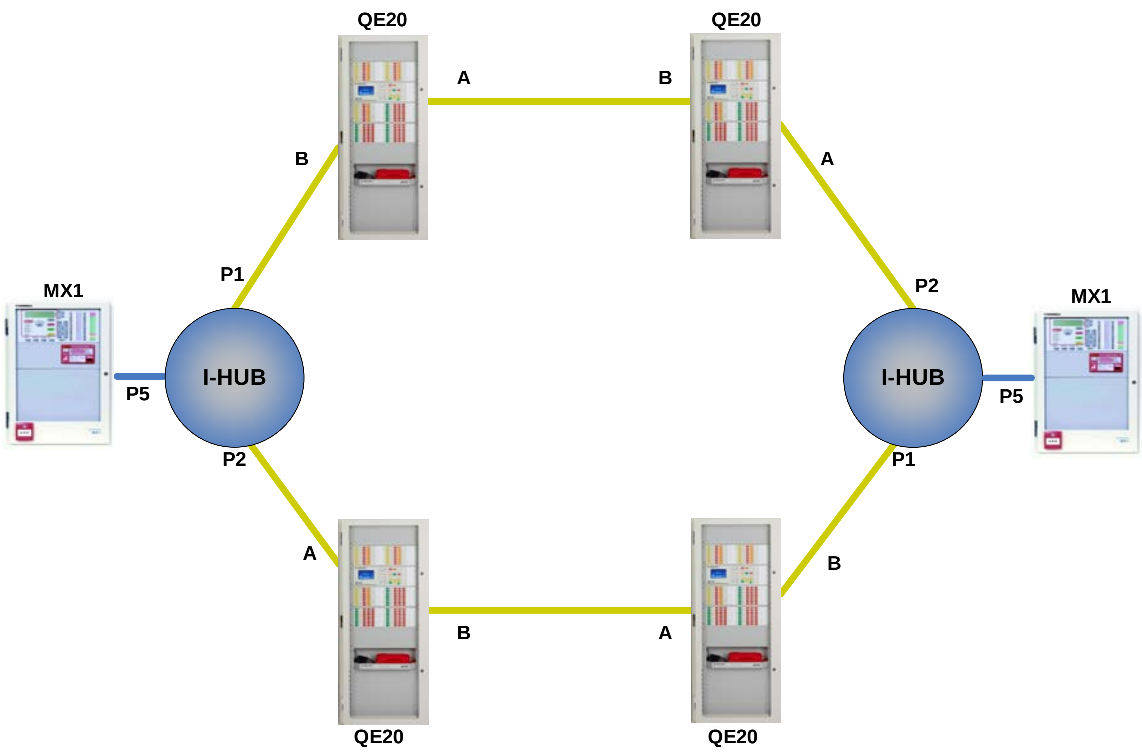

Figure 1.3.4 – Mixed QE20 & MX1 with I-HUB

The I-HUB can also be used to interconnect two or more networks that use different media or signalling speeds as shown in Figure 1.3.5.

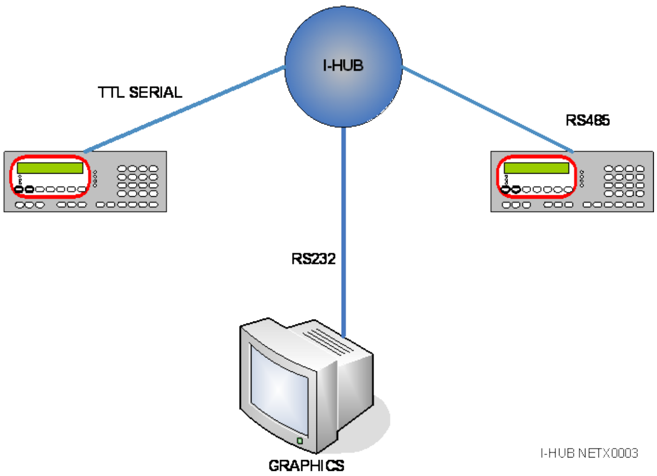

Figure 1.3.5 – Networking Different Media

Two I-HUBs can be used to connect two distant Panel-Link networks together using fibre optic cables, modems or even a customer supplied network (WAN) as shown in Figure 1.3.6.

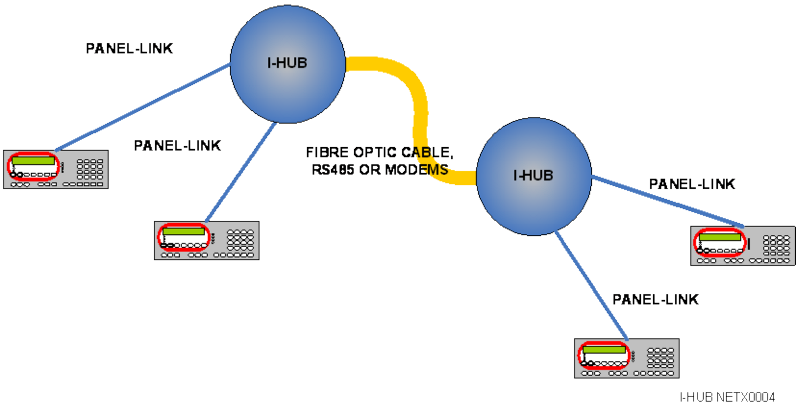

Figure 1.3.6 – Joining Two Networks Together

This can include duplicated paths to link the two networks together as shown in Figure 1.3.7. Two additional I-HUBs are utilised to create a ring network between the networks A and B, thus creating a duplicated path between them.

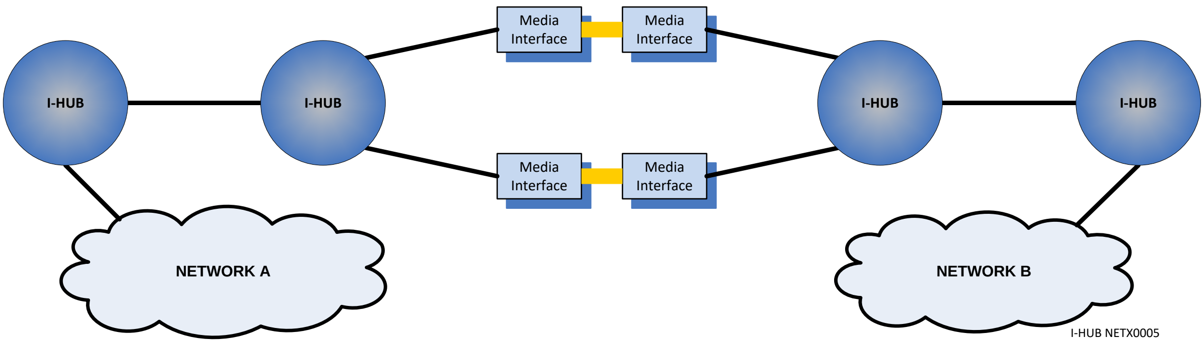

Figure 1.3.7 – Duplicated Paths Join Two Networks

The I-HUB can be used in *MX1* panels to allow these to be on the same network as QE20 Evacuation Panels, and optionally, for the *MX1* to send fire alarm information to the QE20 and receive the fault status from the QE20 panels. Ring networking must be used – as QE20 does not support bus or single channels.

With large systems, care must be taken to minimise the number of messages that are passed through an I-HUB so as to avoid overloading any part of the network. Generally messages from no more than 64 panels should be concentrated into any I-HUB. For slow data links, such as one using 1200 baud modems, the absolute minimum number of messages should be passed across it.

> With the exception of RING mode, network designs that result in more than one path to any one device must be avoided.

1.5 LISTED PRODUCTS & APPLICATIONS

The I-HUB is ActivFire listed to AS 4428.1 for use with the MX4428 and F3200 fire panels using RS485 on copper cables and fibre optic cables with the OSD139HS modems.

The I-HUB is ActivFire listed to AS 7240.2 for use with the *MX1* fire panel using RS485 copper cables. Currently the OSD139 fibre modems have not been assessed to AS 7240.2. The *MX1* is ActivFire listed to AS 7240.2 for networking with other *MX1* panels, the NSA and NDU (for event printing and LED Displays only). It can also be connected to PMB, QE20/ QE90, XLG and a PIB.

MX1 can be networked with F3200, MX4428, the NDU and Compact FF. Refer to the *MX1* Network Design manual LT0564 for details.

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2 SPECIFICATIONS

2.1 GENERAL

2.1.1 ELECTRICAL

I-HUB CIRCUIT BOARD

Electrical Parameters	
Operation Voltage Range	9.6V - 28Vdc
Current Consumption (typical)	140mA – 85mA (9.6V – 28Vdc)

2.1.2 INPUTS AND OUTPUTS

I-HUB Circuit Board Inputs And Outputs	
RS485 1 J7, J8, J14	Network Port 1
RS485 2 J7, J8, J14	Network Port 2
RS232 Port A J5	Network Port 3
RS232 Port B J6	Network Port 4 / Programming / Diagnostics
TTL Serial J4	Network Port 5 / Alternate Diagnostics
Parallel I/O Connector J3	Parallel I/O Connector – used for fault output functionality. I/O Pin 01 is an active high output that goes low when MAF SYSFLT is asserted.

2.1.3 INDICATORS

I-HUB Circuit Board Indicators	
LD1 Red	Flashes briefly when a valid Panel-Link message is received on any port.
LD2 Yellow	Flashes half second on, half second off when I-HUB is running and not in program mode.
LD3 Run Green	On steady when I-HUB is running.
LD4 TXD	Transmitting on network Port 1
LD5 RXD	Receiving from network Port 1
LD6 TXD	Transmitting on network Port 2
LD7 RXD	Receiving from network Port 2

2.1.4 MECHANICAL

I-HUB Physical Parameters	
Dimensions	265mm L x 95mm W x 25mm H
Weight	0.25kg

2.1.5 ENVIRONMENTAL OPERATING CONDITIONS

Environmental Parameters	
Operating temperature range	-5°C to 45°C max
Humidity	95% max (non-condensing)

2.1.6 NETWORKING

Networking Parameters	
Maximum devices per I-HUB ring	64

2.2 SOFTWARE VERSIONS

17/06/99	SF0202 V1.00	First production release.
22/09/99	SF0202 V1.10	
28/09/01	SF0202 V1.11	
17/12/02	SF0202 V1.12	
14/09/04	SF0202 V1.13	
06/08/08	SF0202 V1.14	
31/10/13	SF0202 V2.00	Major revision for *MX1* networking.
18/12/13	SF0202 V2.01	Corrected MAF status sent for NetFlt, PSUFlt.
28/04/14	SF0202 V2.02	Added fault output functionality.
05/06/15	SF0202 V2.03	Fixed problem with multi-drop port.
21/04/16	SF0202 V2.04	New quick config commands MX4428-RING etc.

Newer versions of firmware are fully compatible with older databases. That is, the existing configuration will be retained when the firmware is upgraded.

2.3 ORDERING CODES

FP0770 **NDU TO RING NET UPGRADE KIT**

This unit consists of a new (deeper) back-plate for a slimline NDU, together with an I-HUB mounted on it. This is fitted to the existing NDU front-half, and allows the NDU to have an I-HUB included or be connected to a Panel-Link ring network. A user manual (LT0229), loom to connect to the NDU (LM0152), LM0065 loom to provide a DB9 connection for the I-HUB RS232 port, and mounting parts are included.

FP0771 **I-HUB UPGRADE KIT C/W MTG PLATE**

This consists of an I-HUB mounted on a metal bracket that can be mounted on the right hand side of an F4000/MX4428, F3200 (8U or 15U), or 8U *MX1* panel. For the 15U *MX1* panel it can be mounted on the right hand side of the gear plate. For other larger cabinets it can also be mounted on the gear plate. Included is this manual (LT0229), loom LM0151 for connecting to an older F4000 main board's network port J2, loom LM0152 for connecting to a TTL port on an *MX1* Controller, newer MX4428/F4000 main board's network port J2, or F3200 Network 1 Port J7. A LM0065 loom is also provided for a DB9 connection on the I-HUB RS232 port.

This kit allows an F4000/MX4428, F3200, *MX1* panel, or NDU to include an I-HUB or be connected to a Panel-Link ring network. Note an older F3200 may also require an IC0358 to be fitted to U13.

Also, this kit can be fitted to an NLDU, PTM, NSA, PMB or QE90 to allow them to be connected to the ring network. An additional RS485 board (e.g. KT0144) will be needed for the connection to the NLDU.

FP1032 **OSD139 FIBRE OPTIC MODEM X2 MOUNTING KIT**

This kit includes a bracket for mounting two OSD139 fibre modems inside an *MX1* cabinet, along with two LM0572 looms for connection of the modems to the I-HUB. The bracket mounts in-place of *MX* loop cards in *MX1* panels that are equipped with a suitable gear plate. On the *MX1* gear plate it may be mounted at the top left or at the bottom right. On all panels, it may also be mounted in the position that an RS485 card would occupy.

PA0839 **ECM9603 PANEL-LINK I-HUB**
This includes the I-HUB, software, user's manual (LT0229) and an LM0065 loom for connecting to a PC. Note an LM0076 is also required, but this can be kept with the PC.

LM0076 DB9 Female to DB9 Female "null modem" cable required to connect the LM0065 loom supplied with each I-HUB to a computer.

KT0144 **KIT PMB/TPI RS485 SUPPORT MODULE**
Includes a PA0712 RS485 board, loom to connect to one of the I-HUB's RS232 ports, mounting hardware and instructions. This kit converts an RS232 port into RS485.

PA0712 **PCB ASSEMBLY 1901-139-2 RS485 COMMS BOARD RS232 IN**
This board connects to one of the I-HUBs RS232 ports, converting to RS485. See KT0144 above.

PA0773 **PCB ASSEMBLY 1901-139-3 RS485 BOARD TTL**
This RS485 circuit board module is compatible with the I-HUB's TTL port. A 10-way FRC (LM0084 (0.35m), LM0091 (0.5m), or LM0160 (1.0m)) and mounting facilities are also required.

PA0868 **PCB ASSEMBLY 1931-110 CMOS RS232 INTERFACE**
This circuit board module can be used to convert the I-HUB's TTL port to RS232. A 10-way FRC (LM0084 (0.35m), LM0091 (0.5m), or LM0160 (1.0m)) and mounting facilities are required.

PA0878 **PCB ASSEMBLY 1931-118 CMOS/TTL SIGNAL SPLITTER**
This circuit board module splits a single CMOS/TTL signal into two paths (A+B) for use in duplicated network interfaces.

OSD139HS **HIGH SPEED FIBRE-OPTIC MODEM, MULTI-MODE**
Multi-mode fibre optic RS232 transceiver with female DB25 connector. Uses an ST optical fibre connector.

OSD139HSL **HIGH SPEED FIBRE-OPTIC MODEM, SINGLE-MODE**
Single-mode fibre optic RS232 transceiver with female DB25 connector. Uses an ST optical fibre connector.

PA0483 **PCB ASSEMBLY 1901-103 F4000 IOR UNPROTECTED TERMINATION BOARD**
Termination board for the I-HUB parallel I/O connector. Suitable for application with the fault output functionality of the I-HUB. A 26-way FRC (LM0044 (2m), LM0045 (5m), LM0046 (0.5m), LM0049 (0.25m), LM0056 (1.2m)) and mounting facilities are required.

PA0730 **PCB ASSEMBLY 1922-11-2 24V GENERAL PURPOSE RELAY BOARD**
Relay board for use with signals from the I-HUB parallel I/O connector. Suitable for application with the fault output functionality of the I-HUB.

> To program an I-HUB, an LM0076 loom is required in addition to the LM0065 loom supplied with the I-HUB.

2.4 CABLE ASSEMBLIES & LOOMS

Table 2.4.1 lists the type and description of wiring looms used, or referred to, in this document.

Table 2.4.1 – Loom Part Numbers

Loom Part Number	Description
LM0044	26-way FRC to 26-way FRC ribbon cable – 2m
LM0045	26-way FRC to 26-way FRC ribbon cable – 5m
LM0046	26-way FRC to 26-way FRC ribbon cable – 0.5m
LM0049	26-way FRC to 26-way FRC ribbon cable – 0.25m
LM0056	26-way FRC to 26-way FRC ribbon cable – 1.2m
LM0065	10-way FRC connector to DB9 Male & Female (ribbon cable)
LM0076	DB9 female to DB9 Female 'null modem' cable
LM0084	10-way FRC to 10-way FRC ribbon cable – 0.35m
LM0091	10-way FRC to 10-way FRC ribbon cable – 0.5m
LM0151	10-way FRC to MOLEX connector – special crossover cable
LM0152	10-way header to 10-way header – 4 wire special crossover cable
LM0160	10-way FRC to 10-way FRC ribbon cable – 1.0m
LM0572	I-HUB to OSD139 fibre optic modem connection loom

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3 INSTALLATION & WIRING

3.1 INSTALLATION

3.1.1 SERIES 1948 PSU CABINET MOUNTED I-HUB

In most applications the I-HUB will be mounted within a Fire Indicator Panel (FIP) enclosure and be powered from the FIP power supply. In applications where this is not possible, the I-HUB may be powered from a 1948 power supply (PSU). The Series 1948 PSU cabinet itself cannot accommodate the I-HUB circuit board, and so it is recommended to use an empty 1948 PSU enclosure (part number ME0292) to mount the I-HUB.

The following conditions are required:
- Dry area (inside building);
- Moderate ambient temperature;
- Clear access for viewing and maintenance.

3.1.2 MOUNTING IN FIRE PANEL

The I-HUB printed circuit board should be mounted on an earthed metal plate. In standard F3200 and MX4428 cabinets, and the *MX1* 8U cabinet, there are 4 threaded studs on the right hand inside of the cabinet where the I-HUB on its metal plate can be mounted. For the 15U *MX1* panel, the I-HUB and bracket is mounted on the right hand flange of the gear plate. For the slimline NZ *MX1* panel, the threaded studs are on the left hand side of the cabinet. To mount the metal plate on the threaded studs, unscrew the I-HUB circuit board from the metal bracket, then use the hex nuts, flat washers, and shake-proof washers included in FP0771 to affix the metal plate to the panel. Re-install the I-HUB circuit board after mounting.

Alternatively, metal standoffs can be used with the 8 x 4mm holes on the circuit board. To comply with EMC requirements the I-HUB must be earthed via its mounting positions.

3.1.3 POWER CONNECTIONS

A 9.6V – 28Vdc power supply must be provided to the I-HUB via screw terminal connections +24V, 0V on J13. This power supply must be battery-backed for systems complying with fire standards.

3.1.4 PSU FAULT CONNECTION

The I-HUB accepts the fault output signal of a Power Supply Unit (PSU) and transmits this as a PSU Fault in the I-HUB’s MAF status message. A remote FIP can be programmed to monitor the I-HUB’s MAF status in the same way it can monitor MAF status messages from other FIPs in the network. This way a standalone I-HUB with PSU can be used, and the charger/PSU supervision can comply with the appropriate standards.

The fault output signal from the power supply ‘asserts’ whenever there is a fault with the charging circuit, or when the battery supply has decreased to the battery low point.

If this signal is to be used with the I-HUB, wire the power supply’s PSU FAULT- (J8) to I-HUB PTT+ (J9A). Details for enabling PSU monitoring on the Series 1948 PSU are contained in the manual supplied with each unit.

3.2 CONFIGURATION PORT

The I-HUB port 4 (J6 connector) is used to configure the I-HUB. Port 4 must be connected to a PC operating at 9600 baud, 8 data bits, no parity, and 1 stop bit with XON/XOFF flow control. A terminal program that supports ANSI terminal emulation should be used on the PC. Suitable programs are SmartConfig Terminal, WinComms, and HyperTerminal. Refer to Section 5.2 onwards for programming details.

A null modem cable (LM0076) can be used for this purpose. The cable connects between the 9-pin D connector on the PC and the cable loom (LM0065) plugged into the I-HUB's RS232 port 4 (J6 connector) – see Figure 3.2.1. The pin-out of the 9-pin connector is shown in Table 3.2.

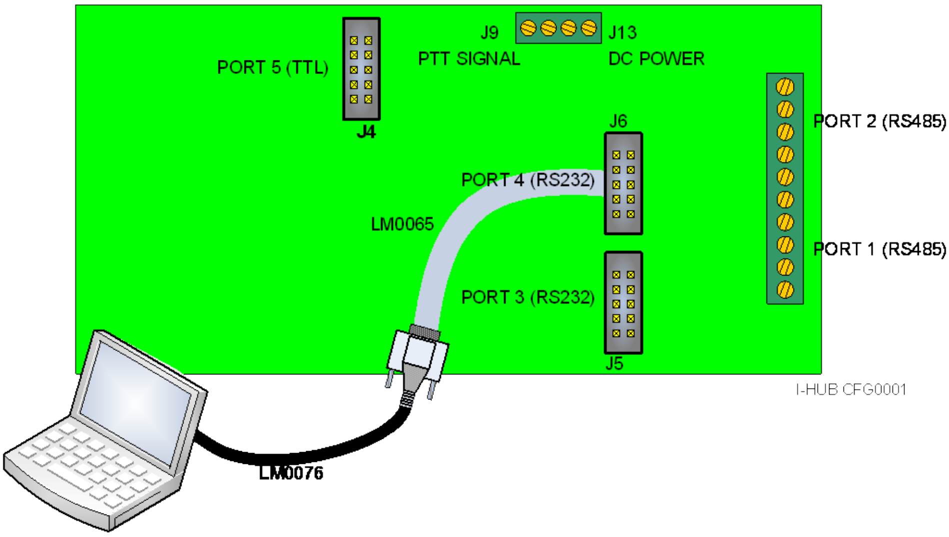


Figure 3.2.1 – Programming Port Cabling

Note: While the I-HUB port 4 also supports network operation, it is recommended that port 4 not be configured as a network port until the overall I-HUB operation has been confirmed and only in the event that all other ports have been used in the network design. This will ensure the programming/diagnostics port is available during system setup and testing.
The rules governing port 4 operational mode are:
If port 4 is enabled for network operation, then diagnostics and message monitoring reverts to port 5, if port 5 is not configured as a network port.

Site-specific data programming can be carried out only on port 4.

Table 3.2 – Port 3 & 4 RS232 Connector Assignments

10-Pin FRC Connector	9-Pin D Connector	Function	RS232-J5 Port 3	RS232-J6 Port 4
1	1	DCD	Connected	Link 6 selects whether DCD or CTS is connected
2	6	DSR	No Connection	No Connection
3	2	RXD	Connected	Connected
4	7	RTS	Connected	Connected
5	3	TXD	Connected	Connected
6	8	CTS	Connected	Link 6 selects whether DCD or CTS is connected
7	4	DTR	Connected	Connected
8	9	RI	Connected	No Connection
9	5	Signal Ground	Ground	Ground
10		NC	No Connection	No Connection

3.3 CONNECTING TO RS485 PORTS 1 & 2

Network ports 1 and 2 correspond to the terminals on the I-HUB labelled RS485 Port 1 and RS485 Port 2 (screw terminal block). These isolated RS485 serial ports are referred to in the configuration section as ports 1 and 2.

Network ports 1 and 2 are operated as a 2-wire ring. Alternatively they can be operated as a dual channel multi-drop 2-wire port, as a single channel multi-drop 2-wire port, or as a single non multi-drop (point-to-point) 4-wire port with one full duplex channel. They cannot be configured to operate independently.

Where doubt exists with regard to the electrical environment or where greater distances are required, ports 1 and 2 may be connected to other I-HUBs via fibre optic converters and cable.

Details for these arrangements are covered in the following sections.

3.3.1 RING, 2-WIRE HALF DUPLEX RS485

Ports 1 and 2 can be combined to operate in a 2-wire ring arrangement with other I-HUBs. This is the recommended configuration.

Links LK11, LK12, LK13 and LK14 must be installed on each I-HUB.
Port 2 must be disabled in the I-HUB configuration.

Wire the RS485 ring, preferably using a shielded cable, from Port 2 TXB+ and TXB- to Port 1 RXA+ and RXA- on the next I-HUB, repeating around the ring as shown in Figure 3.3.1. The cable shields should be wired to the shield terminals. The two shield screw terminals are joined together and are isolated from the chassis and I-HUB power grounds.

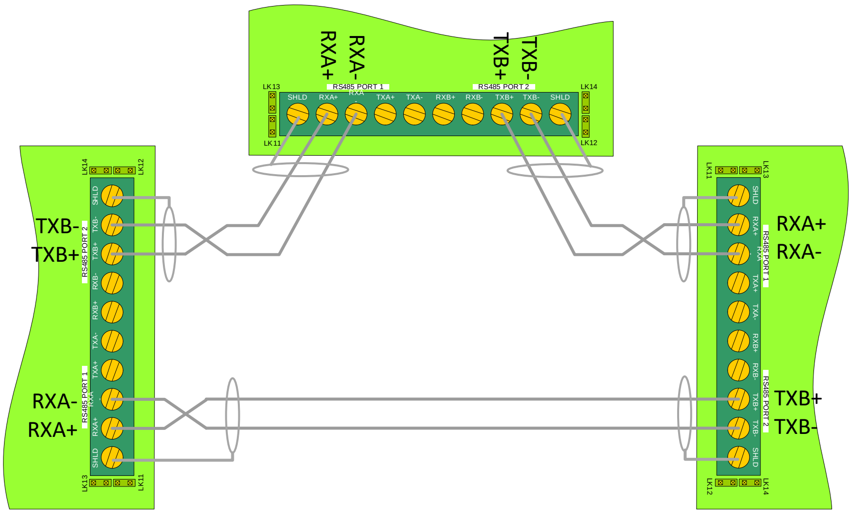


Figure 3.3.1 – RS485 Ring Wiring

In ring mode, the I-HUB network ports 1 and 2 may be configured to operate at speeds up to 57,600 baud. This speed is recommended for new installations. At speeds above 9600 baud, the recommended maximum cable length is 300 meters un-terminated (when using 0.75mm² screened cable).

When ports 1 and 2 are terminated, the cable length (0.75mm² screened cable) may be increased to 1,500 meters. Termination is covered in Section 3.9.

When un-terminated, and speeds are restricted to 9600 baud or below, network ports 1 and 2 are able to operate with cable lengths of up to 1000 meters (when using 0.75mm² screened cable), with due regard to the electrical 'noise' environment. Note though that at 9600 baud the number of networked panels that the network can support will be limited.

3.3.2 RING, 2-WIRE FULL DUPLEX FIBRE OPTIC

Ports 1 and 2 can be combined to operate in a 2-wire ring arrangement with other I-HUBs using fibre optic converters and fibre optic cable. Fibre optic converters convert the RS485 signal interface into optical signals for transfer via optical cable. Fibre optic transmission is not affected in electrically 'noisy' environments and offers significant advantage where long 'cable' lengths are required.

For fibre segments, links LK11 and LK13 (Port 1), LK12 and LK14 (Port 2), (located either side of the screw terminal block) must be removed.

Figure 3.3.2 shows a wiring diagram for use with Optical Systems Design OSD139HS optical transceivers. These are the recommended transceiver for use with the I-HUB. These units support a **maximum** baud rate of 57,600. The DTE/DCE switch must be in the DTE position.

These fibre optic transceivers can be mounted using the FP1032 kit. This kit also includes two looms (LM0572) that can be used to connect each transceiver to the I-HUB and 24V power.

The LM0572 cable should have the 10-way FRC connector cut off, and the labelled leads wired into the appropriate terminals of the I-HUB.

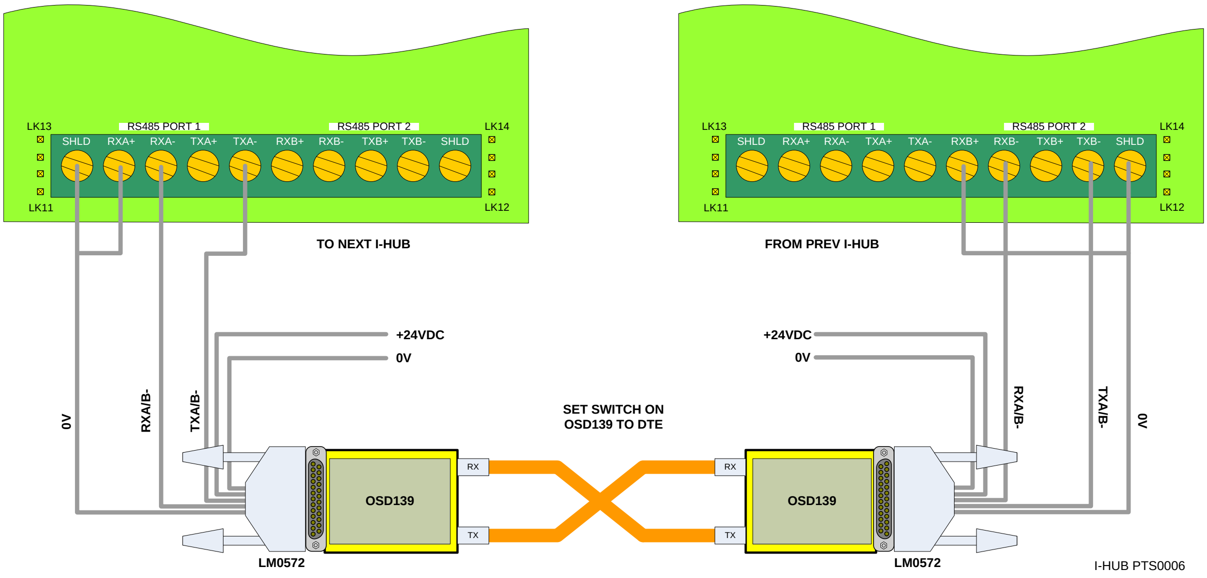


Figure 3.3.2 – Ring Mode Fibre Optic Wiring

The OSD139 fibre optic modem is available in both single-mode (OSD139HSL) and multi-mode (OSD139HS) versions. They have a loss budget of up to 19dB. For single-mode fibre (at 1310nm) this yields a maximum theoretical length of up to 40km. For multi-mode fibre (at 850nm) this yields a maximum theoretical length of up to 3km. (Use of the OSD139A modem on the I-HUB ring is not recommended).

The actual loss along the cable must be calculated (dB/m x length, plus approximately 0.5dB per connector) and also needs to include an allowance for such things as degradation of optical output with time and temperature, so the allowable loss for a given application must be considerably less than 19dB.

Note: In Figures 3.3.2 and 3.3.4 the isolated RS485 ports 1 and 2 are connected to the I-HUB's 0V and 24V. This could violate the earth isolation system and therefore both the segment on port 1 and the segment on port 2 must use fibre optic cabling. Isolation is still maintained between I-HUBs via the non-conductive nature of fibre cabling. Other segments between other I-HUBs in the ring may be implemented using copper-based cabling if required. Consult a JCI technical support engineer if a single fibre connection is required.

Advantec ADAM 4541 (or 4542 for single mode fibre) fibre optic converters have been used in some historic installations, but these are no longer recommended for new installations. For historical compatibility with these systems connection details are provided here. These converters support a baud rate of 57600 and can be interfaced to the I-HUB's Tx and Rx connections on ports 1 and 2. Figure 3.3.6 shows the connections from an I-HUB to two ADAM units to make a fibre-optic ring.

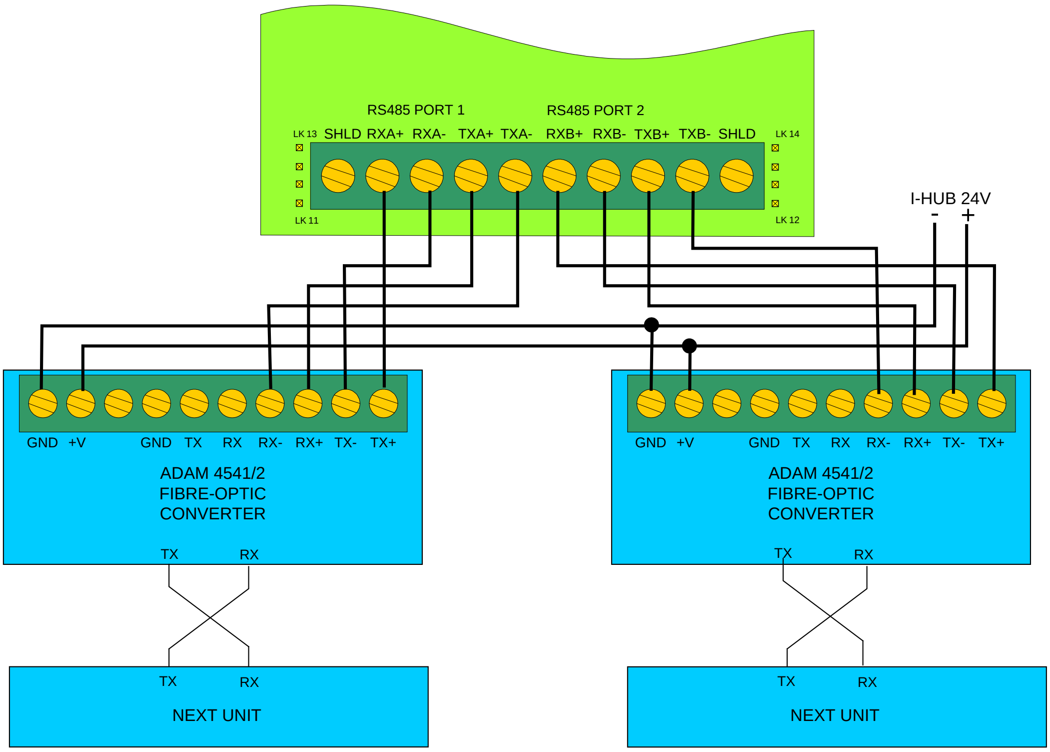


Figure 3.3.6 – Using ADAM 4541/2 on I-HUB Ring (not for new installations)

Set the dipswitch inside the ADAM unit for RS232/422 mode (SW2-9 on, SW2-rest off).

3.3.3 MULTIDROP, 2-WIRE HALF DUPLEX WITH DUPLICATED CHANNELS

The I-HUB ports 1 and 2 can be configured to operate as a duplicated RS485 channel to connect to a multi-drop network of devices (standard Panel-Link networking).

Links LK11, LK12, LK13 and LK14 (located each side of the screw terminal block) must be installed to connect RXA+ to TXA+, RXB+ to TXB+, RXA- to TXA-, and RXB- to TXB-, respectively.

The field wiring connects to TXA+ and TXA- for the A channel, and TXB+ and TXB- for the B channel. Note polarity and channel wiring must be observed between the various modules on the Panel-Link network. Figure 3.3.7 shows how multiple devices are connected.

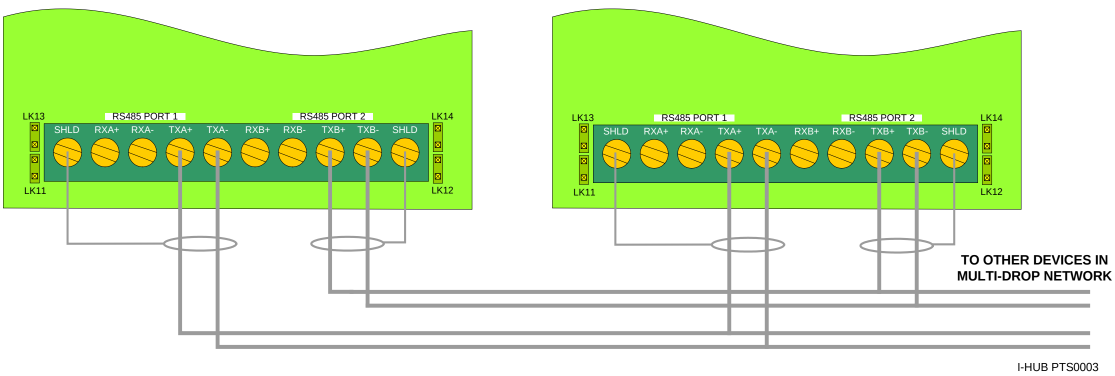


Figure 3.3.7 – Multi-Drop Illustration

Note: At one location, the RS485 cable shielding must be connected to the system chassis.

3.3.4 POINT-TO-POINT, 4-WIRE, FULL DUPLEX SINGLE CHANNEL

This mode is referred to as "point-to-point", as one device (point) can communicate with only one other device (point) using a single full duplex channel. Port 1 is configured as enabled and port 2 is configured as disabled. This mode allows the connection of one remote device using 4 wires to the I-HUB.

The 4 wires are connected to RXA+, RXA-, TXA+ and TXA-. Links LK11, LK12, LK13 and LK14 (located either side of the screw terminal block) must be removed. Terminals RXB+, RXB-, TXB+ and TXB- must be left disconnected.

Terminals RXA+ and RXA- are for receive data. TXA+ and TXA- are transmit data, and must connect to the opposite function at the other device. Refer to Figure 3.3.8.

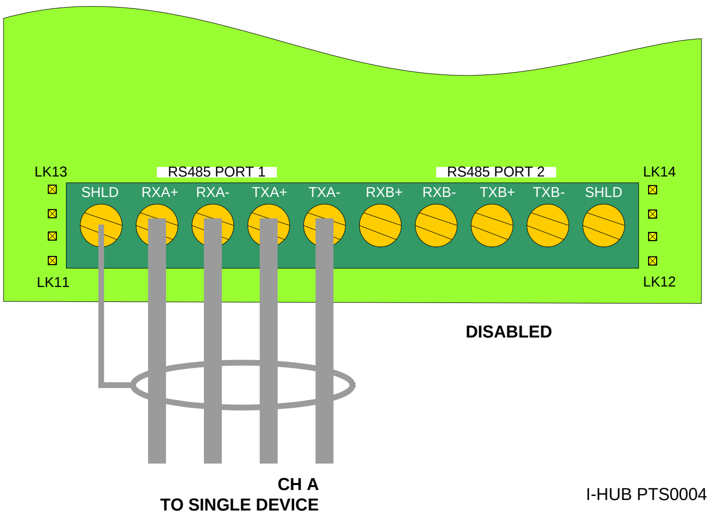


Figure 3.3.8 – Point-To-Point Wiring

If the remote device is using an RS485 board (PA0773) then this should be set to 4-wire full duplex mode (dipswitch SW1 A on, B on, C off, D off) and terminal A+ connects to I-HUB TXA+, A- connects to I-HUB TXA-, B+ connects to I-HUB RXA+ and B- connects to RXA-. If the remote device is an ECM9603-based device (e.g. another I-HUB, or QE90, or PMB), then TXA+ at one device connects to RXA+ at the other device and TXA- connects to RXA- (and vice versa).

The point-to-point 4-wire full duplex configuration is subject to the same cable length and baud rate rules as set out in the introduction to this section (Section 3.3). To terminate this type of connection, fit 150 ohm resistors between TXA+ and TXA-, and between RXA+ and RXA- at each I-HUB. Also fit the two 47k resistors as shown in Section 3.9.

Note that as this is not a duplicated channel configuration, it may not comply with the relevant standards – however it can still be used for communicating with a co-located device.

3.3.5 MULTIDROP, 2-WIRE, HALF DUPLEX SINGLE CHANNEL

If necessary, port 1 can be operated as a multi-drop 2-wire single channel, but this does not typically comply with standards due to being a single point of failure. Port 2 cannot be used.

The field wiring connects to TXA+ and TXA- (or RXA+ and RXA-). Correct polarity and channel wiring must be observed between the various modules on the Panel-Link network. Figure 3.3.9 shows how multiple devices are connected.

Links LK11, LK12, LK13 and LK14 (located each side of the screw terminal block) must be installed to connect RXA+ to TXA+, RXB+ to TXB+, RXA- to TXA-, and RXB- to TXB-, respectively.

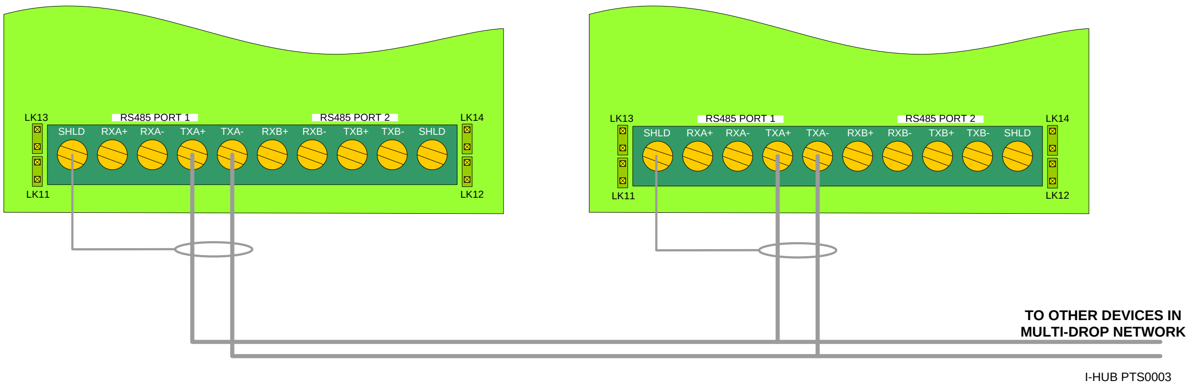


Figure 3.3.9 – Single Channel Multi-Drop Illustration (must use Port 1)

Note: At one location, the RS485 cable shielding must be connected to the system chassis.

Port 1 should be programmed to not transmit Link Integrity messages, using:

```
SET PLINK PORT 1 LINKTX 0
```

as it cannot use the other port (2) to transmit the alternative channel (B) message.

Therefore, a panel each side of the I-HUB connection must be programmed to expect Link Integrity messages from a device on the other side of the connection to provide link monitoring.

3.4 CONNECTING TO RS232 PORTS 3 AND 4

RS232 Port A (connector J5) on the I-HUB is referred to as port 3.
RS232 Port B (connector J6) on the I-HUB is referred to as port 4.
See Figure 3.4.1 for the location of these ports on the I-HUB.

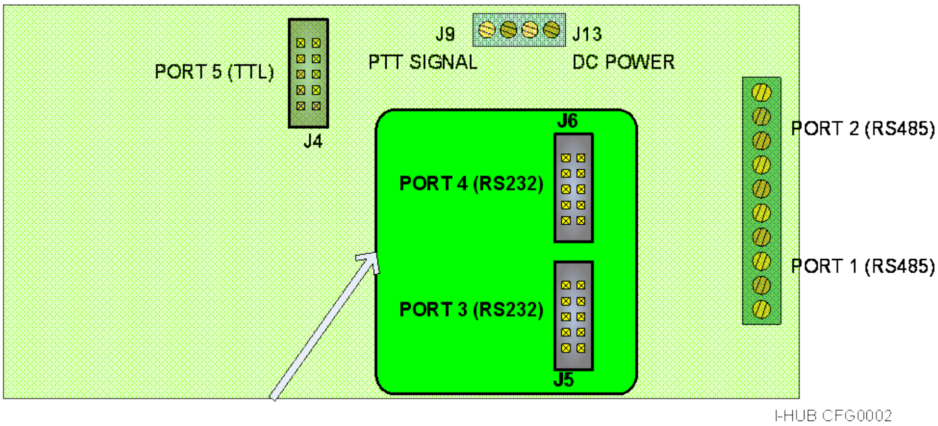


Figure 3.4.1 – Port 3 & 4 Locations on the I-HUB

A 10-way FRC is used to connect to each of these ports with the following pin-outs:

RS232 PORT A (J5) Communication Port 3

Pin	Function/Signal
1	DCD Input
2	No connection
3	RXD Input
4	RTS Output
5	TXD Output
6	CTS Input
7	DTR Output
8	RI (can also be used as a special input)
9	GND (signal)
10	No connection

RS232 PORT B (J6) Communication Port 4

Pin	Function/Signal
1	DCD Input (when LK6 in position 1-2, else N/C
2	No connection
3	RXD Input
4	RTS Output
5	TXD Output
6	CTS Input (when LK6 in position 2-3, else N/C
7	DTR Output
8	No connection
9	GND (signal)
10	No connection

Port 3 and port 4 operate independently with the exception that if the baud rate of one of the ports is set to 38400, the other may not be set to 19200. While port 3 and 4 would normally be set to 9600 baud, depending on the application, port 3 may be used to connect to a remote FIP via a modem. Port 3 in this instance would be set to match the modem's line speed.

The DCD and CTS inputs are ignored on both ports, and the DTR output is always asserted.

When the port mode is configured as MULTIDROP or PNTOPNRTSC, the RTS output from the port is used to clock the duplicated channel logic on the PA0712 RS232/RS485 converter module (PA0712 and PA0773 are discussed in section 3.8). If the mode is configured as PNTOPNRTSC (point-to-point mode) then RTS is asserted only while transmitting. When the mode is configured to PNTOPN, then RTS is always asserted.

3.4.1 NATIVE RS232

RS232 can be used to directly connect to another RS232 device, usually located within 15m, as no electrical isolation is provided. External compatible modems (or other data transfer systems such as fibre optic cable) can be used for long distance connections. RXD at one end connects to TXD at the other end.

3.4.2 CONVERSION TO RS485 VOLTAGE LEVELS

A VIGILANT RS232/RS485 board (PA0712) can be used to provide an isolated RS485 interface that operates in duplicated channel mode. This allows port 3 to connect to other RS485 systems, e.g. an RS485 multi-drop Panel-Link network. The PA0712 provides duplicated channel capability at the RS485 level. Duplicated channels provide an additional level of cable fault tolerance.

The connection can be either dual channel 2-wire (MODE = MULTIDROP) to a network of devices, or point-to-point (MODE = PNTOPN) 4-wire full duplex to a single device. A baud rate of 2400, 4800, 9600 or 19200 may be used. The RS485 Panel-Link network normally runs at 9600 baud.

A 10-way FRC is used to connect from port 3 (J5) on the I-HUB to J5 on the PA0712 RS232/RS485 board. The PA0712 RS232/RS485 board will also need 24 volts wired to connector J6. Refer to section 3.7.1.

3.4.3 CONVERSION TO TTL VOLTAGE LEVELS

A VIGILANT PA0868 CMOS RS232 interface board can be used to convert port 3 to TTL levels if required to connect directly to an F4000 or F3200 fire panel in point-to-point mode. However, it is recommended that the I-HUB's port 5 (TTL port) be used for this type of connection.

> A cable length of no more than 1.5 metres should be used with a TTL connection. Furthermore the power supply that supplies the I-HUB must also power the equipment that the TTL port is being connected to.

Wiring for this may be obtained from JCI Technical Support in Christchurch on request.

3.4.4 CONVERSION TO SINGLE CHANNEL OPTICAL FIBRE

For applications where duplicated fibre paths are not required, the 10-way connector of LM0572 can be plugged directly into port 3 or 4 of the I-HUB. The other end of the loom is then to be plugged into the OSD139 fibre modem. The black (0V) and red (+24V) wires should then have their ends stripped and be connected to the I-HUB as depicted in Figure 3.4.5.

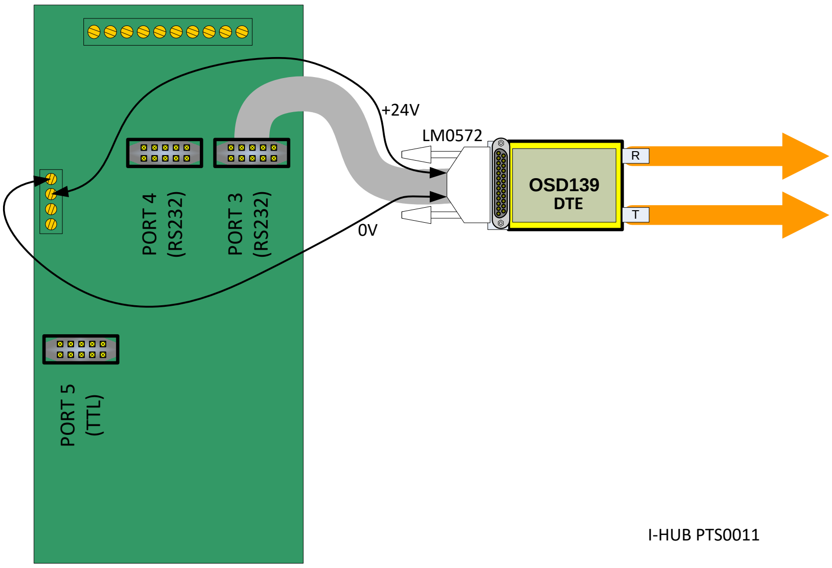


Figure 3.4.5 – Single Channel Optical Fibre Connection

3.5 CONNECTING TO TTL SERIAL PORT 5

The TTL serial port (J4) is referred to as port 5 – see Figure 3.5.1 for location. The TTL port without additional level conversion should be considered as a suitable connection only when the equipment and the I-HUB are co-located and attached to the same power supply. This is the usual connection used for connecting a fire panel for the I-HUB.

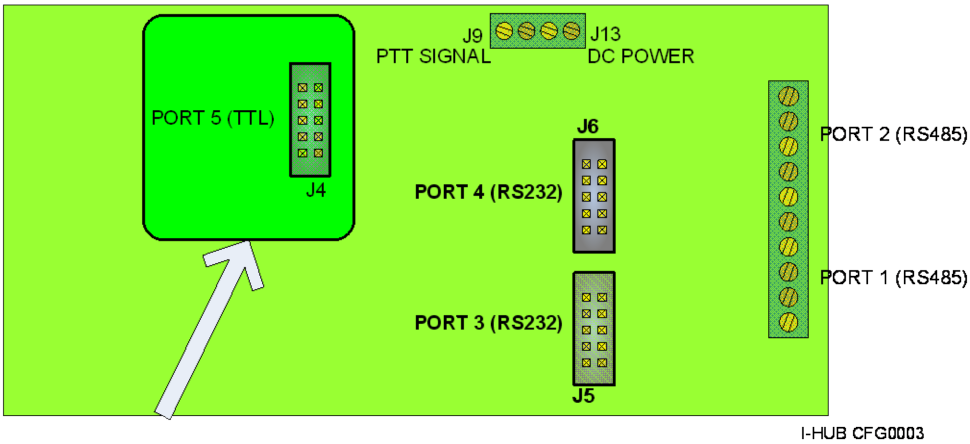


Figure 3.5.1 – Port 5 Location

Warning: Do not plug or unplug cables to/from the TTL connector(J4) while the I-HUB is powered on. This can permanently damage the I-HUB.

Warning: Do not connect RS232 or RS485 signals directly to the TTL port, as you will damage the I-HUB.

A 10-way FRC is used to connect to this port at connector J4 on the I-HUB controller board, which has the following pin-out:

TTL PORT (J4) Communication Port 5

Pin	Function/Signal
1	+24V Out
2	+24V with link LK7 fitted, else no connection
3	RXD Input
4	TX Data Output
5	RTS Output
6	CTS do not connect
7	0V
8	0V
9	DCD do not connect
10	+5V

Port 5 can be used several ways:

- At TTL levels with a maximum cable length of 1.5 metres to another compatible device. E.g. F4000/MX4428 main board using a loom LM0151, or an F3200/NDU controller, *MX1* Controller, F4000/MX4428 main board issue C or higher, or ADU (compact FF or NSA) TTL Serial Port 0 J2 using loom LM0152. The I-HUB must be connected to the same power supply as the FIP.

- Connected to a PA0773 RS485 board via loom LM0084, which in turn is connected to either a multi-drop RS485 network or a single channel point-to-point RS485 connection. While the connection can be physically made to a multi-drop RS485 network using this port, this port should NOT be used for duplicated channel operation, as the two channels cannot be independently supervised with Link-Integrity messages in both directions. This port does not support channel switching using RTS.

- Connected to a PA0868 CMOS/RS232 interface board via loom LM0084 to convert the signals to RS232.

- Connected to a VIGILANT 1200-baud modem (PA0464) (now obsolete) using special wiring, or to any modem that accepts a TTL input.

Details are contained in the following sections.

If not configured as a network port, port 5 may be used as the diagnostic port when port 4 is being used as a network port. This will require a PA0868 CMOS/RS232 board and a LM0084 FRC Loom. The number of logic level converters (TTL-RS232, RS232-TTL and RS232-RS485) should be minimized as each additional converter adds signal distortion into the network.

3.5.1 CONVERSION TO RS232 LEVELS

The TTL port can be converted to RS232 levels by using the CMOS – RS232 interface board (PA0868) and an LM0084 FRC. This would normally be a point-to-point connection to one other device.

The PA0868 allows the TXD and RXD signals to be interchanged and therefore act as a DTE or DCE device. Normally the PA0868 would be configured as a DTE device.

PA0868 LK1 & LK2 Settings

DTE
LK1 Fit 1-2, 3-4
LK2 Fit 1-2, 3-4

DCE
LK1 Fit 1-3, 2-4
LK2 Fit 1-3, 2-4

The older PA0445 CMOS to RS232 converter may also be used, but this will require a modified FRC connector cable to join to the MOLEX connector on the PA0445 to the I-HUB port. The wiring for this is as follows:

Pin 7 (RXD) on the MOLEX connector of PA0445 connects to pin 3 (RXD) of the I-HUB TTL port J4.
Pin 8 (TXD) on PA0445 connects to pin 4 TXD on I-HUB.
Pin 12 (0V) on PA0445 connects to pin 7 or 8 (0V) on I-HUB.
Pin 2 (5V) on PA0445 connects to pin 10 (5V) on I-HUB J4.
Pin 9 (RTS) on PA0445 connects to pin 5 (RTS) on I-HUB J4.
Pin 3 (TXD) of the DB25 connector on PA0445 should be connected to RXD at the other end.
Pin 2 (RXD) of the DB25 on PA0445 should connect to TXD at the other end.
Pin 7 (0V) of the DB25 should connect to 0V.
Pin 4 (RTS) may connect to RTS at the other end if necessary.

3.5.2 CONVERSION TO RS485

An RS485 Communication Board (PA0773) can be connected to the I-HUB TTL port 5 and can be used in a RS485 panel-link network or point-to-point mode to one other device. While the connection can be physically made to a multi-drop RS485 network using port 5, this port should NOT be used for duplicated channel operation, as the two channels cannot be independently supervised with Link-Integrity messages in both directions. This port does not support channel switching using RTS.

A 10-way FRC connects the RS485 communication board to the TTL port on the I-HUB, using loom LM0084.

3.6 I-HUB LINK SETTINGS

On issue A I-HUB circuit boards, links LK13 and LK14 do not exist. On I-HUB issue B boards, link LK2 does not exist.

Link	Position
1	1-3, 4-5
2	1-2 (4M) Issue A only.
3	1-2
4 (EEPROM WRITE ENABLE)	1-2 = WRITE ENABLE NOT LINKED = WRITE PROTECT
5	1-2 (+24V position) Don't care.
6	(1-2) (DCD position)
7	Not Fitted
8	Not Fitted
9	Not Fitted
10	Not Fitted
11 Issue A	Not Fitted
12 Issue A	Not Fitted
11, 13 Issue B	Port 1 Multi-drop – Fitted
	Port 1 Point-to-Point – Not Fitted
	Port 1 Ring Mode – Fitted
12, 14 Issue B	Port 2 Multi-drop – Fitted
	Port 2 Point-to-Point – Not Fitted
	Port 2 Ring Mode – Fitted

3.7 PA07XX RS485 COMMUNICATION BOARD

3.7.1 GENERAL

There are currently three versions of the RS485 communication board. They are:

PA0711 - RS485 Communication Board
PA0712 - RS485 Communication Board with RS232 port
PA0773 - RS485 Communication Board, TTL Interface (FRC Connector)

The **PA0711** is used to interface old Issue A & B versions of the F4000 main board with an RS485 network. The RS485 communication board is mounted on the modem connector, located at the top of the F4000 main board.

The **PA0712** is used to convert between RS485 and RS232 level signals and can be used to connect an RS232 I-HUB port to an RS485 network. Because RS485 links can be much longer than RS232, two PA0712s can be used to transmit serial data over long cables between devices that have RS232 serial ports.

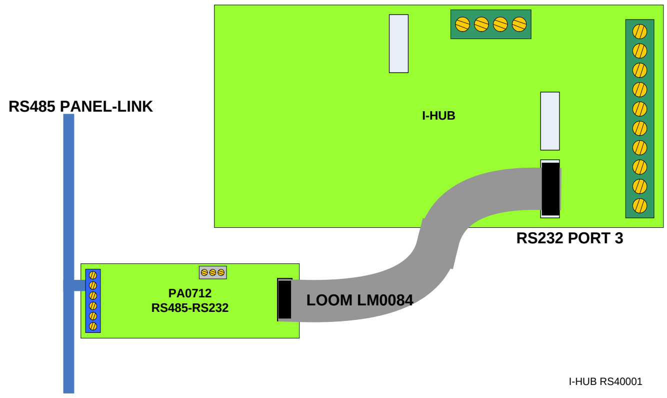


Figure 3.7.1 – Application of PA0712 Module on I-HUB RS232 Ports

The **PA0773** can be used to connect the TTL port 5 of an I-HUB to an RS485 network. Note that duplicated channel mode is not fully supported. Refer to notes in section 3.5.

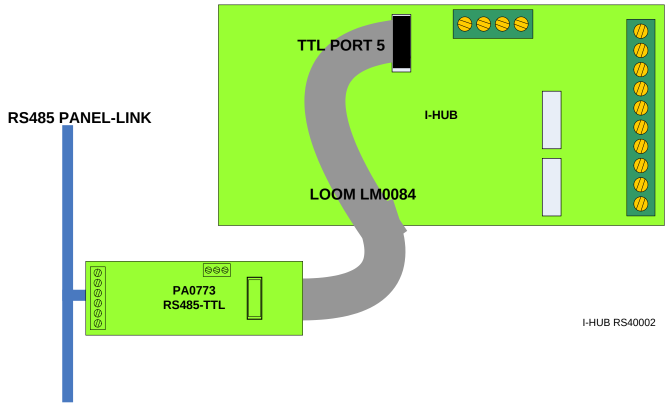


Figure 3.7.2 – Application of PA0773 Module on I-HUB TTL Port 5

The PA0773 is also used to interface an issue C or higher F4000/MX4428 main board, F3200 FIP, PTM, NLDU, or NDU to an RS485 network. This RS485 communication board is mounted on four metal stand-offs, which are used for earthing the board. This RS485 board connects to the controller board via a 10-way FRC, which also provides power to the RS485 board.

NOTE: Systems using VIGILANT RS485 communication board may be connected to systems using RS485 equipment from other manufacturers. However, to achieve successful communication, the + and - signal connections of each channel may need to be crossed over between the two systems, i.e. A+/- to A-/+, and/or B+/- to B-/+.

Further details of the PA0712 and PA0773 may be found in documents LT0152 and LT0069.

3.7.2 DIPSWITCH, WIRING & LINK SETTINGS CONNECTING TO AN I-HUB

A PA0712 can be connected to I-HUB RS232 port 3 or 4, or a PA0773 can be connected to I-HUB TTL port 5. The connection may be a point-to-point link to one other device, or a multi-drop link to a network of devices. Duplicated channels are supported on only ports 3 or 4.

3.7.2.1 Multi-drop

Link settings (PA0712 only)

LK1 - 1-2 (fitted)
LK2 - 1-2 (fitted)
LK3 - 1-3 linked
2-4 linked
LK4 - 1-2 linked
3-4 linked

Switch SW1

A	B	C	D
ON	OFF	ON	ON

Wiring

When connecting to another RS485 board (PA0711, PA0712 or PA0773)

A+ to A+
A- to A-
B+ to B+
B- to B-

3.7.2.2 Point-To-Point

Switch SW1 (4-wire Full Duplex with RT/RX Always)

A	B	C	D
ON	ON	OFF	OFF

Link settings (PA0712 only)

LK1 - 1-2 (fitted)
LK2 - 1-2 (fitted)
LK3 - 1-3 linked
2-4 linked
LK4 - 1-2 linked
3-4 linked

Wiring

When connecting to another RS485 board (PA0711, PA0712, or PA0773)

I-HUB RS485 Board	Remote RS485 Board
A+	B+
A-	B-
B+	A+
B-	A-

When connecting to an ECM9603 based device, RS485 port 1 (e.g. QE90, I-HUB, PMB).

RS485 Board	ECM Board Port 1
A+	TXA+
A-	TXA-
B+	RXA+
B-	RXA-

3.8 USING MODEMS WITH I-HUB

3.8.1 RS232 PORTS 3 & 4 WITH V-MODEM

Where it is necessary to extend a Panel-Link network (non-duplicated) across leased lines, the VIGILANT V-Modem can be used. The V-Modem is a 2400 baud full duplex modem capable of leased line or dial-up operation.

For a non-duplicated link, a V-Modem is required at each end. The V-Modem has an RS232 interface and may be connected to I-HUB ports 3 or 4 via LM0166 and LM0065. Figure 3.8.1 shows an application with V-Modem being used to 'transport' data between two networks.

Duplicated channels are not easily obtainable with modems.

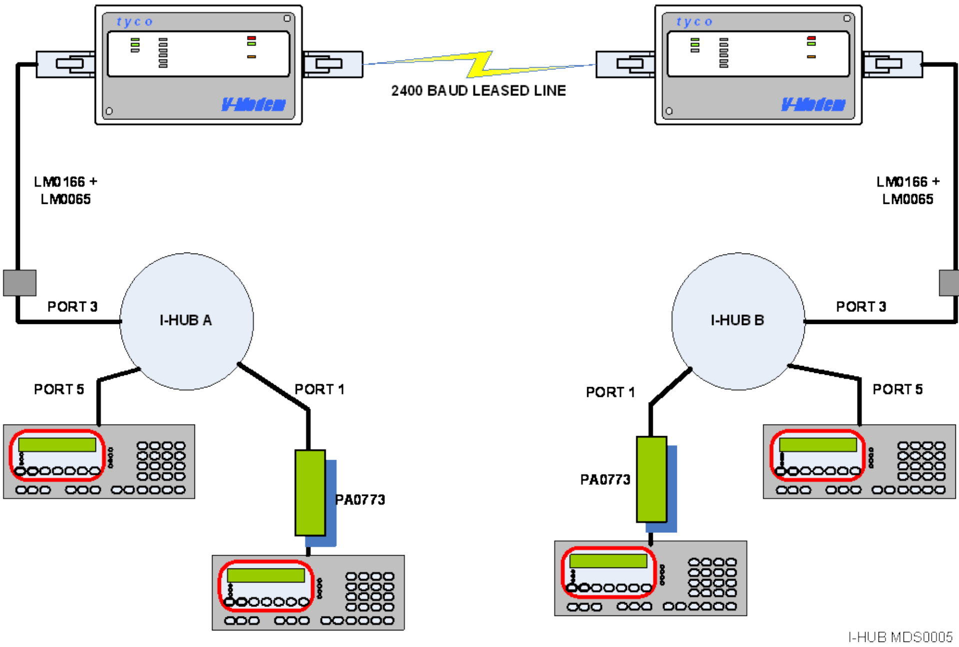


Figure 3.8.1 – Point-To-Point V-Modem Link over Leased Lines

The V-Modem can operate from 24V DC. Connect an LM0166 and LM0065 between the V-Modem and the serial port of the I-HUB.

Both V-Modems must be configured to use NO FLOW control and set to 2400 baud DTE speed. One V-Modem must be set to "Leased Originate" and the other to "Leased Answer".

The V-Modem is described in more detail in document LT0243.

3.8.2 RS232 PORTS WITH PA0468 MODEM (LEGACY)

The I-HUB's RS232 ports can be connected to a VIGILANT PA0468 (RS232) 1200 baud modem. The PA0468 is no longer available, so the information for the PA0468 is included for technical reference only.

If the PA0468 is to be used in a configuration it should preferably be connected to port 3 rather than port 4. The link can be either point-to-point to one other device, or multi-drop with only a small number of devices (up to 4) connected.

The wiring connection for this is shown in Figure 3.8.2.

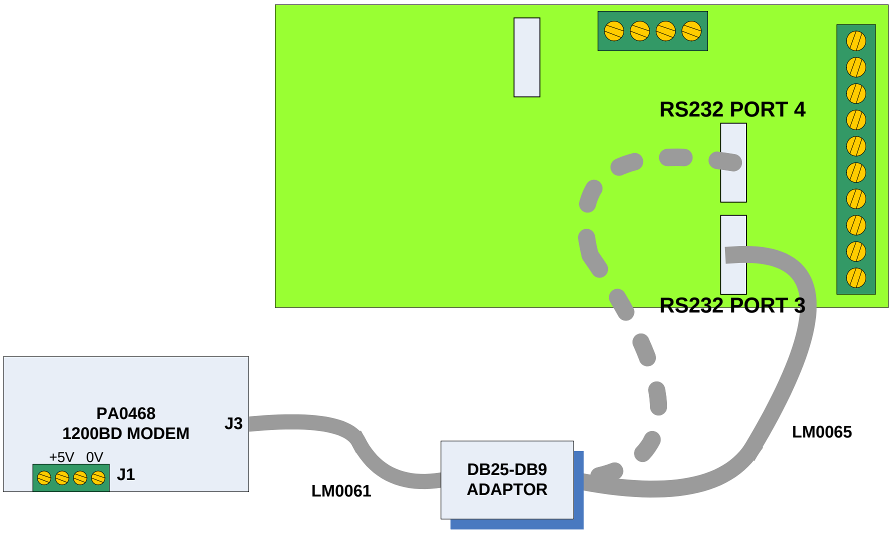


Figure 3.8.2 – RS232 Ports with PA0468 (Legacy)

The PA0468 requires 5 volts wired to connector J1.

On the PA0468 links LK9 and LK10 must be fitted. Link LK11 should be installed on the two pins furthest from the 16-way connector J3 to make the connection (RTS). Link LK12 should be not fitted (actually it is "don't care"). Links LK1, LK2, LK3 should be fitted to select 1200 baud. Link LK7 should be set according to the receive signal levels - refer to the 1200 Baud Modem Manual (LT0127). Link LK8 should be fitted for multi-drop mode and removed for point-to-point mode.

3.8.3 TTL SERIAL PORT WITH PA0464 (LEGACY)

The TTL port can also be connected to the now-obsolete PA0464 (CMOS) 1200-baud modem board. This can be either a point-to-point link to one other device or multi-drop mode with only a small number of devices (up to 4).

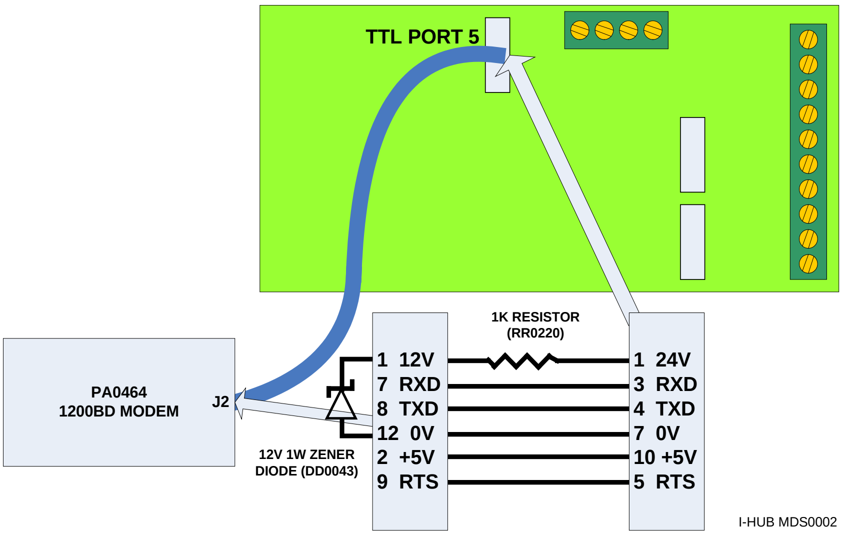


Figure 3.8.3 – TTL Port with (Legacy) Modem PA0464

The connection for this is shown in Figure 3.8.3 and incorporates a resistor and zener diode.

The modem board must have links LK1, LK2, LK3 fitted to select 1200 baud, link LK7 set according to the received signal level. Link LK8 is removed for point-to-point mode, and LK8 is fitted for multi-drop mode.

For point-to-point mode two modems are connected with four wires, with the TX pair of wires on one board going to the Rx pair of wires on the other modem board and vice versa, as shown in Figure 3.8.4.

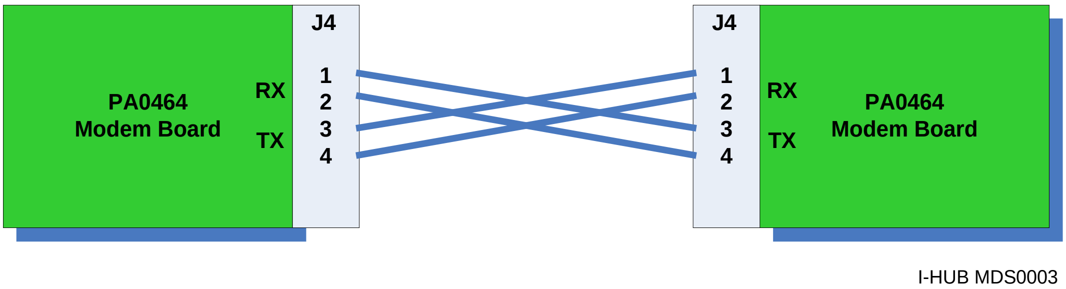


Figure 3.8.4 – Point-To-Point PA0464 Modem

For multi-drop mode, only two wires are used and these connect to pins 3 and 4 (TX) of each modem board as shown in Figure 3.8.5. Note LK8 on the modem must be fitted in multi-drop mode.

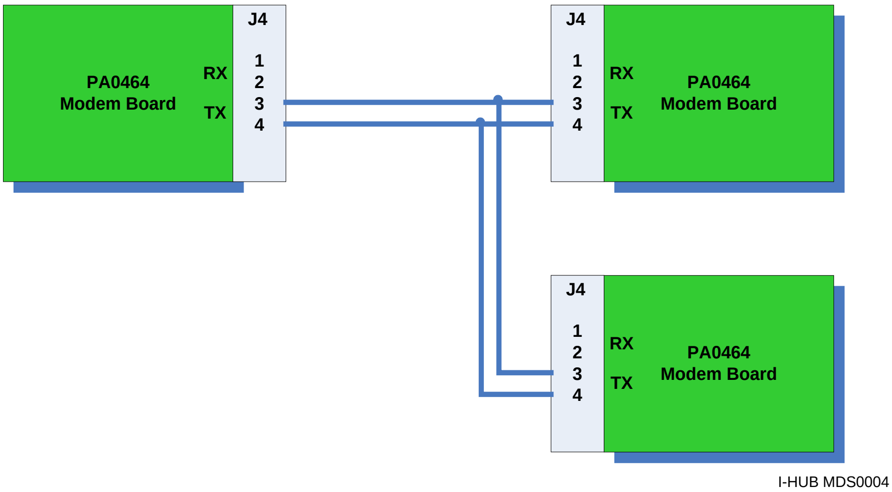


Figure 3.8.5 – Multipoint with PA0464 Modem

Further details for the 1200-baud modem can be found in the 1200 Baud Modem Manual (LT0127).

3.9 TERMINATING RS485 CONNECTIONS

Termination as described below is necessary only if network cables are longer than 1000m at 9600 baud or 300m at 57600 baud.

3.9.1 TERMINATING PORTS 1 & 2 IN RING MODE

To terminate the RS485 ports on the I-HUB operating in ring mode, fit two 150 ohm resistors as shown in Figure 3.9.1. The I-HUB module must also be fitted with two 'bias' resistors by connecting a 47k resistor from pin 12 to pin 14 of each of U16 and U17 (2 * 47k resistors per I-HUB).

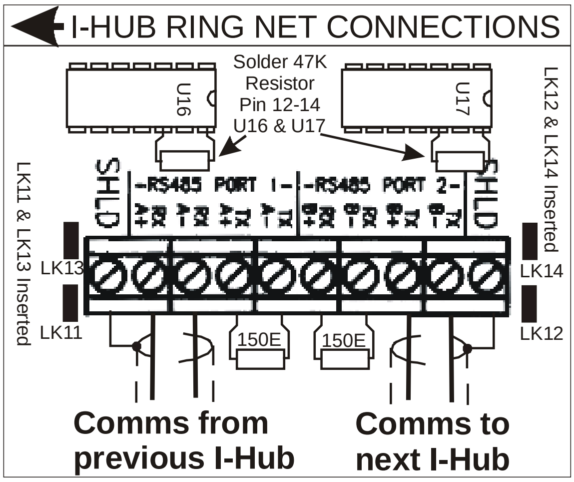


Figure 3.9.1 – Terminating the RS485 Bus in Ring Mode

Table 3.9.1 – Summary of cable lengths

Baud Rate	No Termination & No Bias Resistors Fitted	Termination & Bias Resistors Fitted
9600	1000 meters	2000 meters
57600	300 meters	1500 meters

3.9.2 STANDARD MULTIDROP PANEL-LINK

To terminate a standard multi-drop Panel-Link network fit a 150 ohm resistor at each end of the bus (each channel if duplicated). In addition, do one of the following:

(i) If only ECM Port 1 and 2 type RS485 ports (e.g. I-HUB, QE90, PMB) are connected and no RS485 converter boards (PA0711, PA0712, PA0773), also add the 2 x 47k resistors to the ECM as per Figure 3.9.1.

(ii) If any nodes use the RS485 converter boards, modify one of them by changing R20, R21, R22, and R23 from 33k to 1k (soldering 4 x 1k2 resistors "piggyback" in parallel would achieve this). The node with this module must be always powered up. If it is powered down, it could stop the whole bus from working.

Refer to Table 3.9.1 for the maximum network cable lengths with and without the termination and bias resistors fitted.

Figure 3.9.2 shows the location of resistors R20, R21, R22 and R23 (shown shaded).

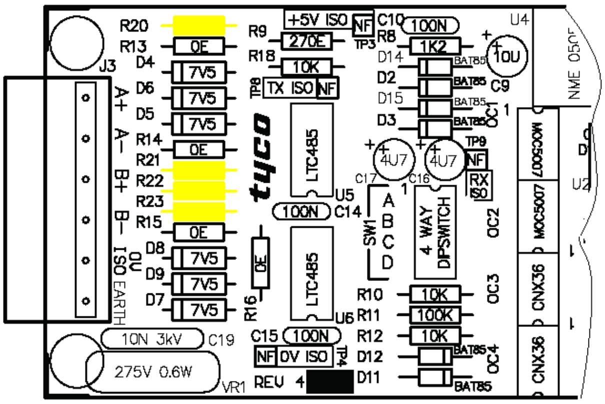


Figure 3.9.2 – Resistor Locations on PA0711, PA0712 & PA0773.

Terminating the RS485 bus on converter modules such as the PA0711, PA0712 and PA0773 will allow greater cable lengths to be used on the RS485 segments these modules serve. However, the segment baud rate may be restricted by the devices attached to the TTL and RS232 ports of these converters. For example, if a PA0773 converter module has its TTL port directly attached to the network port of a F3200 FIP, then its speed is determined by the F3200 FIP and not the RS485 bus.

3.10 FIELD CONVERSION OF ECM TO I-HUB MODULE

In some instances it may be required to convert an ECM module (e.g. from a QE90 panel or general spare) to an I-HUB. To do this will require the following parts:

1 x IC0352 IC 28C256 EEPROM 32KX8 CMOS
1 x SF0202 SOFTWARE PANEL-LINK I-HUB

Fit the IC0352 to U5 and the SF0202 software to U2. Refer to Section 3.6 for the link settings.

3.11 FAULT OUTPUT

I/O pin 01 of the parallel I/O connector J3 may be used as a fault output for devices that can't interpret MAF status from the Panel-Link network such as QE90. It is an active high output and goes low when MAF SYSFLT is asserted as described in Section 4.2.6.
For this to work, the I-HUB must have NETMAFTX enabled i.e. the I-HUB must have the following.

```
IHUB NETMAFTX ENABLE
```

The hardware required to utilise this functionality is a PA0483 termination board and a PA0730 relay board. A 26-way FRC loom is required to connect the two boards – LM0044 (2m), LM0045 (5m), LM0046 (0.5m), LM0049 (0.25m), LM0056 (1.2m).

The normally closed output of the relay board should be used.

4 NETWORK SYSTEM DESIGN

4.1 I-HUB OPERATION

The primary function of the I-HUB is to pass selected messages received on one port to one or more other ports. This allows the physical size of a Panel-Link system to be extended and also allows devices on different physical media types to be connected. The I-HUB transmits its status onto the network for other devices to monitor. It is also possible for configurations that require it, for the I-HUB to transmit its own Link Integrity, MAF status, and event messages onto one or more ports.

4.1.1 PANEL-LINK AND SID NUMBERING

The VIGILANT networking protocol is called Panel-Link. All Panel-Link messages contain SID (System Identification) numbers (source and destination) and most devices residing on a Panel-Link network must be allocated a single unique SID number. The exceptions being pass-through devices like the PIB, or an I-HUB configured to borrow the SID of a connected *MX1* – no SID is allocated. Earlier I-HUB firmware (V1.xx) required two SID numbers per I-HUB. Each message on a Panel-Link network is either a broadcast type (destination SID = 0) or a non-broadcast type (destination SID = non zero).

4.1.2 NETWORK TOPOLOGY

For a large Panel-Link network with many nodes to perform well, it is important that a minimum number of messages are passed from one physical segment of the network to another. This is so that delays on messages getting through the I-HUB are minimised and also so that there is a minimum amount of traffic on each network segment, which helps performance.

Where possible, 'like' communication interfaces should connect to the same type of interface on the opposing equipment. For example, if the FIP network interface type is TTL then ideally it should be connected to the TTL port 5 on the I-HUB. If the FIP network interface is RS232 then it should be connected to one of the I-HUB's RS232 ports.

Furthermore, networks should be planned with a redundant pathway for data transmission. In many cases this is a requirement of the fire standards governing the installation and performance of fire panel equipment. To illustrate this, consider Figure 4.1.1.

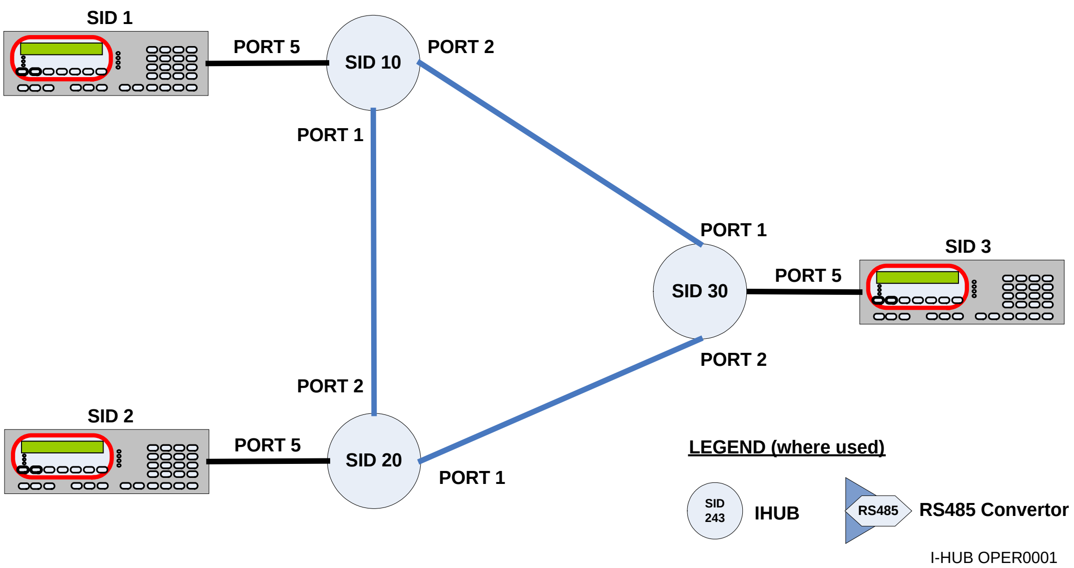


Figure 4.1.1 – I-HUB Ring Example

In Figure 4.1.1 there are three FIPs (SID 1, 2 and 3), each 'housing' an individual I-HUB module (SID 10, 20 and 30) powered from the FIP power supply. Each of the FIPs is connected to its I-HUB via TTL port 5. The I-HUB Ports 1 and 2 form a "ring" network at the RS485 level. The network illustrated in Figure 4.1.1 can tolerate a single break in the RS485 ring and still maintain communication with ALL devices. Furthermore if a fault develops in one of the I-HUBs then the other FIPs on the network are not "disconnected" as messages in ring mode are sent in both directions. Figure 4.1.2 illustrates the effect when the ring is broken, or an I-HUB fails in a ring configuration.

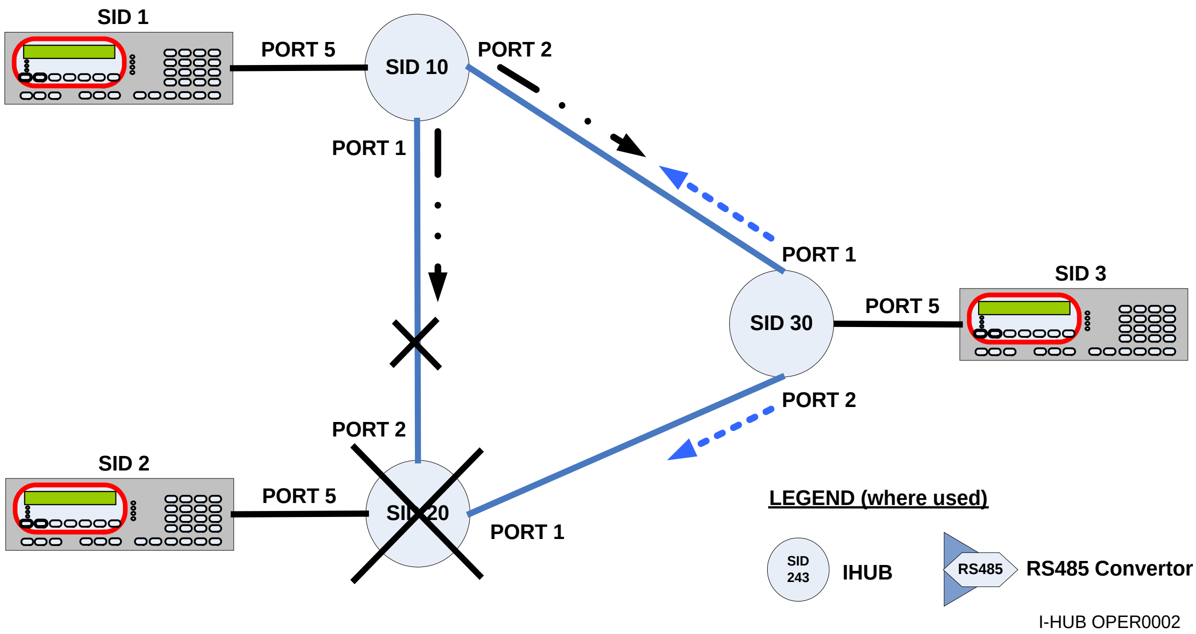


Figure 4.1.2 – I-HUB Ring Resilience

With the I-HUB's versatile configuration capabilities there are many different network arrangements that may be created.

4.1.3 NETWORK LOADING

During the network design phase, for large networks, it is important to identify the message loading that will occur on network segments and, in the case where a centralized FIP, PMB, PTM or Colour Graphics is monitoring the status and events from a number of remote or distributed FIPs, consider the message burden placed on the central device. For example, there are limits to how many messages should be sent to MX4428, F3200, etc. Also, messaging from more than 64 nodes should not be concentrated at any I-HUB.

By using the default network settings for F3200, F4000/MX4428, and *MX1* FIPs it is possible to work out the theoretical load that could be placed on a central FIP. For example the default network message transmission settings for the F3200, F4000/MX4428, and *MX1* FIPs are:

Message Type	TX Period	
	F3200, F4000/MX4428	*MX1*
Link Integrity TX	2 messages every 5 seconds	2 messages every 15 seconds
MAF Status	2 messages every 20 seconds	2 messages every 120 seconds
NETVAR TX	1 message every 20 seconds	1 message every 60 seconds
Status Refresh	1 message every 10*1 / 23*2 seconds	1 message every 60 seconds

*1 = MX4428 *2 = F3200

Additionally, I-HUBs using V2.00 or later firmware with the broadcast of I-HUB status messages enabled (if MX1DEFAULTS is used, it is enabled) will send an I-HUB status message every 120 seconds when the I-HUBs are in a normal state.

In planning a network, assume worst case and accept that most of the above message types are to be enabled for transmission by the remote FIPs. Status refresh will be excluded in this example as it is required by only certain products (QE20/QE90, XLG Colour Graphics, PMB). The default settings for the F3200/MX4428 FIPs indicate that every twenty seconds the central FIP will receive two MAF messages, one NETVAR, and eight Link Integrity messages (total 11) from each remote panel. With two remote FIPs this is a total of 22 messages in 20 seconds – an average of 1.1 messages per second.

As a guide, F3200 and F4000/MX4428 FIPs (when lightly loaded with local detectors and output logic) can handle a sustained incoming message rate of 15 messages per second at 9,600 baud (and higher peak loads under alarm conditions). Therefore if an F3200 or F4000/MX4428 was deployed in the above example, it could easily handle this message load.

For a network of F3200 or MX4428 panels, only when the number of remote FIPs exceeds 28, will the message rate exceed the rating of a F3200 or F4000/MX4428 central FIP, i.e. 28 x 11 = 308 messages in 20 seconds = 15.4 messages per second. If the Link Integrity transmission rate is now reduced to 2 messages every 10 seconds at each remote FIP, this will drastically reduce the average message load. Now each panel will send only seven messages in a twenty second period. With these settings the central FIP could support 42 remote FIPs. Changing the transmission rate for all FIPs to match the defaults of *MX1* FIPs will allow a F3200 or F4000/MX4428 central FIP to support 64 nodes, a message rate at the central FIP of 11.7 messages per second.

An *MX1* panel (with DSS controls) will send 24 messages every 60 seconds (when it is in the normal state). An *MX1* with no DSS controls sends 12 messages every 60 seconds. An *MX1* can support at least 45 incoming messages per second. With a full I-HUB ring of 64 I-HUBs and *MX1* panels (all sending DSS data) the total message rate is 25 messages/second, well within the capability of the *MX1* to receive. Therefore no specific message filtering is required to reduce the message load.

Of note, for non-*MX1* FIPs, increasing the baud rate of the link between the FIP and the I-HUB port to 19200 will have a negative effect on the FIP's ability to handle messages. The reason for this is that messages will then be sent toward the FIP from the buffered message queues in the I-HUB more frequently. This increases the FIP's communication overhead to the point where it has insufficient time to fully service the associated processing as the result of incoming messages.

Good network design must try to balance the loading and at the same time achieve a cost-effective approach. The following sections explore this further.

4.1.4 PANEL-LINK MESSAGE ADDRESSING

From the point of view of how messages are addressed to their various destinations, there are two types of messages:

- Uniquely addressed
  Messages are sent with the destination SID equal to the SID for where the message is to be delivered (SID = 1-254). There is also a special SID of 255 (0xFF) that corresponds to the single receiving device on a point-to-point link.
- Broadcast
  Messages are sent with a special destination SID (=0) and are delivered to all destination panels that the programmed routing permits.

4.2 I-HUB CONFIGURATION CONCEPTS

A useful set of default configuration settings may be activated with the `MX1DEFAULTS` command. For simple *MX1* networking this may be all the configuration that is required.

There are three distinct groups of I-HUB configuration commands:
Global Commands, Physical Port Commands, and SID routing and filtering commands.

4.2.1 GLOBAL (I-HUB) COMMANDS

Global commands are a relatively small set of configuration commands, which apply to the overall operation of the I-HUB. These are commands that set the I-HUB's SID address, and whether the I-HUB should generate MAF status, etc. These commands start with I-HUB.

For example:

```
IHUB SID 156
```

This command will assign a SID of 156 to the I-HUB.

I-HUBs using V2.00 or later firmware occupy one or zero SID addresses (never two as was required with the V1.xx firmware). Therefore, the `IHUB NUMADDRESSES` command is ignored if given. If the SID is set to `NONE`, then the SID of the *MX1* connected on TTL port 5 is 'borrowed' by the I-HUB and it does not require one allocated to itself.
SID borrowing is prohibited when MAF status transmission, I-HUB fault master, or Link Integrity transmission functionality is enabled. It is also prohibited when ports 1 and 2 are not in ring mode, or ports 3 or 4 are enabled. In such situations the I-HUB will prevent the database from being saved if a SID is not assigned.

If the I-HUB will be required to transmit its own MAF status then this can be enabled by:

```
IHUB NETMAFTX ENABLE
```

The rate at which the I-HUB will transmit its own MAF status is set by the command:

```
IHUB NETMAFTX 20 10
```

4.2.2 PHYSICAL PORT (PORT) COMMANDS

Physical port commands, e.g. `PORT 5 BAUD 19200`, apply to the I-HUB's Panel-Link serial ports. This group of commands determine the operational characteristics of the serial port(s), such as baud rate, connection type, and generally affect the basic operation of that port. Physical PORT commands are described in detail in section 5.6 "Programming Commands".

The SET PLINK prefix is not required with I-HUB V2.00 and later firmware.

4.2.3 ROUTING AND FILTERING (PORT & SID) COMMANDS

4.2.3.1 General

This group of commands determines how the I-HUB 'routes' and 'filters' messages received on any of its network ports. Many commands have port-oriented variants in that they apply to all traffic from that port, these are new for V2.xx and later firmware. Others are SID-oriented. The commands have the following formats:

```
SID list/range PORT p
SID list/range NOWHERE
PORT list/range LEARNSIDS ENABLE / DISABLE
PORT list/range PASSLINKI TXPORT a,b,c…
SID list/range PASSLINKI TXPORT a,b,c…
PORT list/range PASSAPP ALL TXPORT a,b,c…
SID list/range PASSAPP ALL TXPORT a,b,c…
PORT list/range PASSAPP a,b,c…TXPORT x,y,z…
SID list/range PASSAPP a,b,c…TXPORT x,y,z…
SID list/range ACKBCAPP ALL
```

Note there is a format for the PASSAPP command that specifies particular applications, and another that specifies ALL applications.

The concept of this group is best illustrated by a series of simple examples.

Our application will consist of two remote FIPs attached to an I-HUB 'A' (SID 100) and one Master FIP (SID 11) located at a central position attached to I-HUB 'B'. I-HUB A will be mounted in SID 12 with SID 10 remote, and I-HUB B will be mounted in SID 11. The I-HUBs are arranged in RING mode via ports 1 and 2. This is shown in Figure 4.2.1.

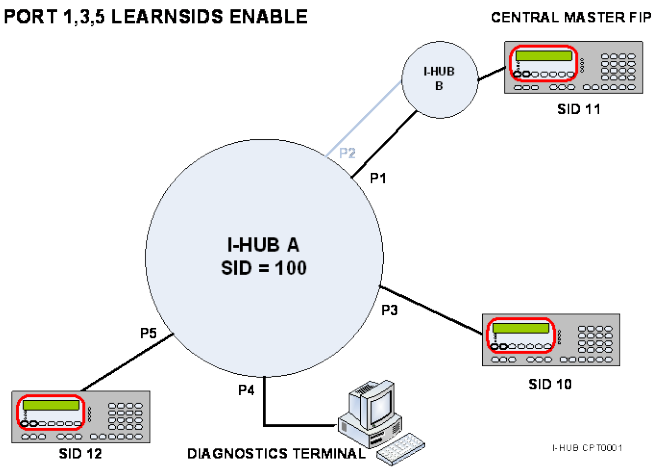


Figure 4.2.1 – I-HUB Sample Application (Concept 1)

The I-HUB routes a message to a port when it has knowledge that the destination SID is located on that port.

It is easiest to program the I-HUB to automatically learn the location of SIDs so this information does not need to be programmed manually. For I-HUB A this may be achieved with the following:

```
PORT 1,3,5 LEARNSIDS ENABLE
```

In our simple illustration of Figure 4.2.1 the following can be said for I-HUB A:

SID	Is On
10	Port 3
11	Port 1
12	Port 5

If automatic SID learning is not used, then the `SID list/range PORT y` command specifies to the I-HUB where SID(s) are located. By issuing `SID list/range PORT y` commands, a picture is built up telling the I-HUB on which port each SID is to be found. i.e.,

```
SID 10 PORT 3
SID 11 PORT 1
SID 12 PORT 5
```

Now whenever the I-HUB receives any message destined for SID 12 it will transmit or pass that message to port 5. If the I-HUB receives any message for SID 10 it will transmit it to port 3 and so on.

If the I-HUB receives a message for a destination SID it does not know of, then the message is silently discarded.

4.2.3.2 Application Broadcast Filtering

All Panel-Link messages contain information that identifies the category of data contained within the message. This is called the application number.

The different application messages that are broadcast (not addressed to a specific destination SID) may be filtered by the I-HUB through the use of the PASSAPP type command.

The following forms of PASSAPP are available:

```
PORT list/range PASSAPP a,b,c… TXPORT x,y,z…
SID list/range PASSAPP a,b,c… TXPORT x,y,z…
PORT list/range PASSAPP ALL TXPORT x,y,z…
SID list/range PASSAPP ALL TXPORT x,y,z…
```

Note that the PASSAPP command can be applied to messages coming from SID(s) or port(s). Also, in simple terms the use of ALL implies that NO filtering is to take place and that the I-HUB should route or transmit all application messages from particular port(s)/SID(s) via TXPORT x.

To continue the illustration of Figure 4.2.1, consider now Figure 4.2.2. If `PORT 3,5 PASSAPP ALL TXPORT 1` is issued then this tells the I-HUB that ALL broadcast messages received from ports 3 and 5 are to be transmitted onwards to port 1. In the network depicted this transmits broadcast messages from SIDs 10 and 12 onto port 1 as shown in Figure 4.2.2.

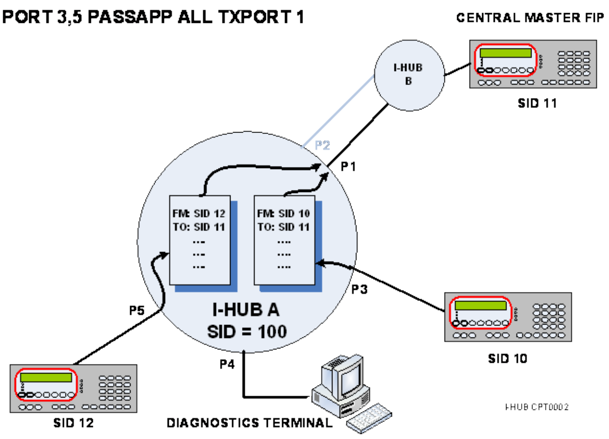


Figure 4.2.2 – I-HUB Concepts 2

To allow messages from the "Master Panel" (SID 11) to be routed to local SIDs 10 and 12 (e.g command messages from the main panel to the sub panels), use `PORT 1 PASSAPP ALL TXPORT 3,5.` Broadcast messages arriving into the I-HUB from SID 11 are now sent to both I-HUB ports 3 and 5, as shown in Figure 4.2.3.

By the absence of message routing commands from Port 3 to 5, and vice versa, the I-HUB will not send broadcast messages between these two ports.

The inclusion of certain application names or numbers after the PASSAPP type implies that only messages for these applications are to be routed. For example the command `PORT 5 PASSAPP FF TXPORT 1` would have the effect of filtering out or discarding all other broadcast messages apart from those for the FF application.

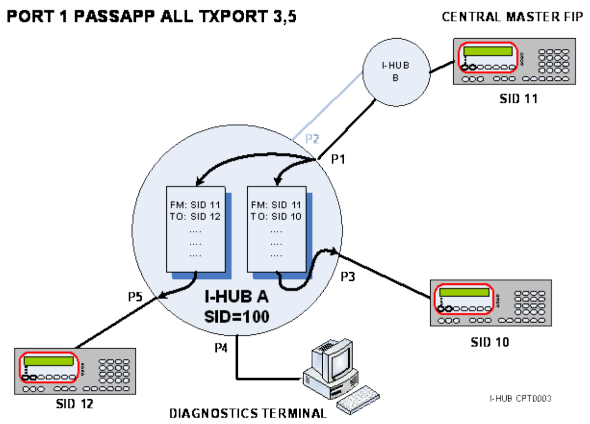


Figure 4.2.3 – I-HUB Concepts 3

The inclusion of application names or numbers after the PASSAPP token in the command line can therefore be used to fine tune a large network. For broadcast messages, the "PASSAPP" command determines which ports a broadcast message is re-transmitted on when it has been received by the I-HUB. For non-broadcast messages, if a message for a particular SID is received on a port which is not the port the destination SID is configured as being on, then the I-HUB will first send an acknowledge message on the port the message was received on (on behalf of the destination SID) and will then transmit the message on the port the SID is located on.

This means that the following types of messages will generally be subject to "PASSAPP" filtering as they are usually broadcast:

PASSAPP Text	App No.	Description
FF	0	FF "LCD Text" event messages (unless sent to a specific SID)
EVENT	2	Event Logging ("Printer") messages
MAF	1	MAF Status messages
NETVARS	4	Network variables
STATUS	5	Status Transfer messages
CMDCTRL	6	Command & Control – Time/Date updates and Sounder Silence
QE90, QE90B	7 & 8	QE90 & QE20 Messages

Command and Control (App No. 6) and Tandem Mode (App No. 9) messages are generally sent to specific devices and will be routed through the I-HUB if it can identify the port location of the destination device. Note that the time and date and sounder silence messages use App No. 6, so they need to be included in the PASSAPP list if routing of these broadcasts is required.

4.2.3.3 Link Integrity

Link integrity is an integral part of Panel-Link networking. Link Integrity messages can be used to monitor the status of the physical connections between intelligent network devices. At regular intervals, devices that are so programmed will broadcast a specific Link Integrity message. Two types of Link Integrity message exist: A and B. For duplicated cable networks (excluding the ring for I-HUB V2.00 firmware or later), only one of A and B will be sent to each separate signal path. For the ring with I-HUB V2.00 or later firmware, both A and B messages will be sent to each path – this differs from I-HUB V1.xx firmware where only one type is sent to each path. For single cables, the path-specific messages are both sent onto the one path.
Other network devices are programmed to expect these messages at regular intervals. If they fail to receive at least one of these messages on the relevant signal path within a programmed time, a communications or scan fail fault is generated. The fault automatically clears when the messages are next received.

It should be noted that the separate channel Link Integrity messages received on a port of the I-HUB are combined and transmitted down both channels of any dual channel paths they are routed to. To illustrate this, Figure 4.2.4 shows a small network incorporating an I-HUB. Link Integrity messages arriving on I-HUB port 3 from SIDS 10, 11 and 12 are combined and transmitted down I-HUB ports 1 and 2. These Link Integrity messages provide integrity checking for the duplicated cabling path between SIDs 10, 11 and 12 and the I-HUB only. In order to monitor the integrity of the dual cabling between I-HUB ports 1 and 2 and SID 20 (FIP), the I-HUB must also be configured to send its own Link Integrity messages on ports 1 and 2 as well as port 3. If the I-HUB was not configured to do this, a break in one of the cables between the I-HUB port 1 or 2 and SID 20 would be not detected by SID 20 as both A + B messages would be received via the other cable channel. Enabling the transmission of Link Integrity by the I-HUB on port 3, allows the FIPS (10,11& 12) to detect a break in the RS485 multi-drop segment they are attached to.

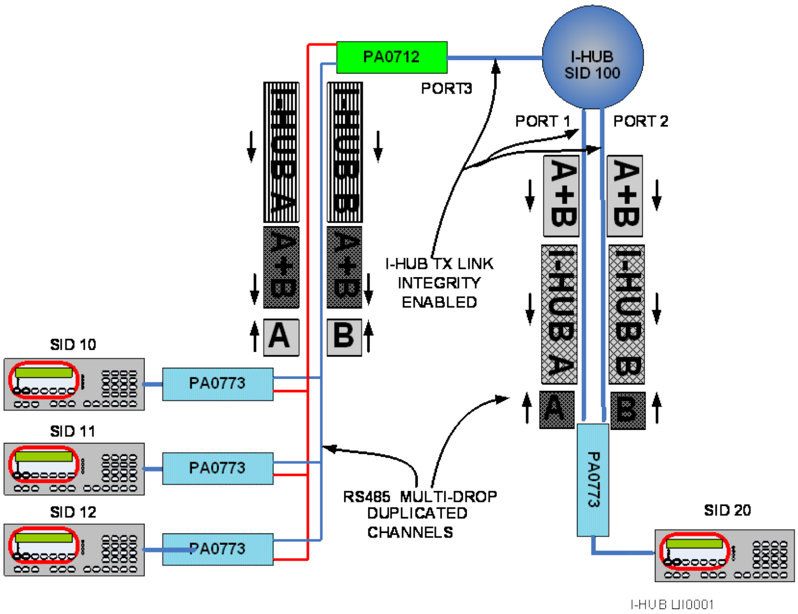


Figure 4.2.4 – Dual Channel Link Integrity

In Figure 4.2.4, the following message 'keys' were used to show the Link Integrity messages:

A B — Dual channel A and B messages generated by FIPS 10, 11 and 12.

A B — Dual channel A and B messages generated by FIP 20.

A+B — Combined 'I-HUB routed' Link Integrity messages from FIPS 10, 11 and 12

I-HUB B — Dual channel I-HUB generated Link Integrity on ports 1 and 2.

I-HUB A — Dual channel I-HUB generated Link Integrity on port 3.

A+B — Combined 'I-HUB routed' Link Integrity messages from FIP 20.

How the I-HUB deals with Link Integrity messages is controlled via the `PORT list/range PASSLINKI TXPORT a,b,c…` or `SID list/range PASSLINKI TXPORT a,b,c…` commands.

Since Link Integrity messages have no destination SID address in the message (like a broadcast message), the PASSLINKI command can be thought of as an extra filtering command. Consider Figure 4.2.5.

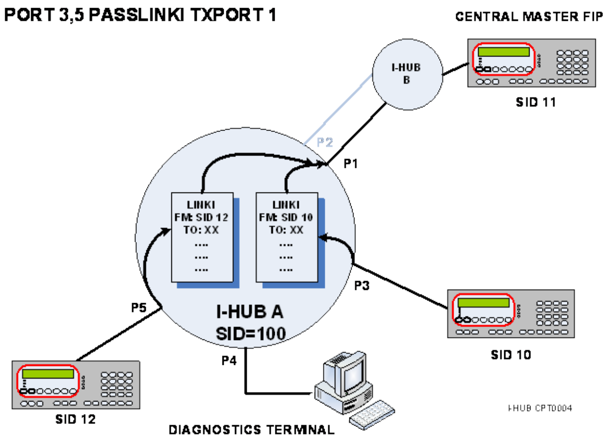


Figure 4.2.5 – I-HUB Concepts 4

The PASSLINKI command determines whether Link Integrity messages received from a particular SID or port will be re-transmitted on another port. In Figure 4.2.5, the I-HUB has been configured to transmit all Link Integrity messages received from ports 3 and 5 onto port 1 (in this illustration toward the "master"), but not between Ports 3 and 5.

4.2.4 I-HUB B EXAMPLE

To complete the example, Figures 4.2.6 through 4.2.8 consider the configuration of the I-HUB at the master panel location (I-HUB B). In Figure 4.2.6 the I-HUB B configuration has enabled SID learning (via the `PORT 1,5 LEARNSIDS ENABLE` command) so that the locations of SIDs 10 & 12 being on port 1 and SID 11 being attached to port 5 is learnt automatically.

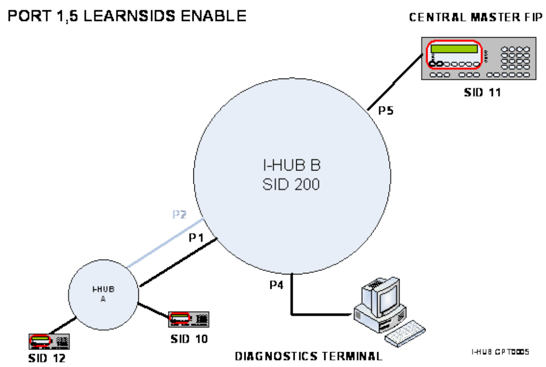


Figure 4.2.6 – I-HUB Concepts 5

The I-HUB must also be told where to pass broadcast messages. Figure 4.2.7 shows the effect of the PASSAPP ALL command. Application messages arriving into the I-HUB from port 1 (SIDs 10 and 12) are transmitted to port 5 (to the master panel).

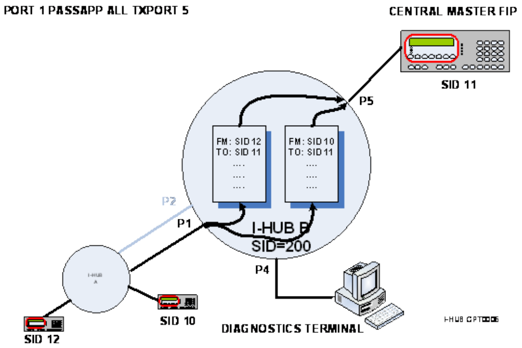


Figure 4.2.7 – I-HUB Concepts 6

In this example I-HUB B is required to also pass Link Integrity messages toward the master panel. Figure 4.2.8 shows the effect of this.

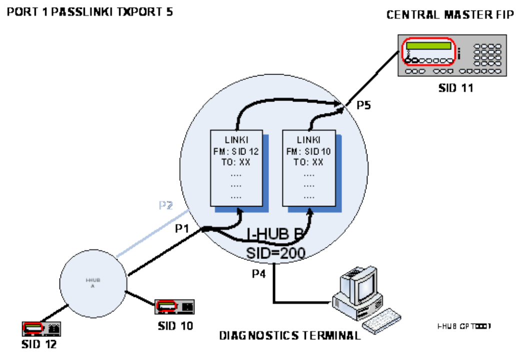


Figure 4.2.8 – I-HUB Concepts 7

Note also that the master panel must be programmed to monitor the Link Integrity messages of SIDs 10 and 12.

4.2.5 EXAMPLE SUMMARY

Continuing our example, the configurations for the two I-HUBs are as follows.

I-HUB A

```
CLEARDB
IHUB SID 100
IHUB NETMAFTX ENABLE
IHUB NETMAFTX 20 10
IHUB BCASTIHUBSTATUS ENABLE
PORT 1-2 BAUD 57600
PORT 1-2 MODE RING
PORT 5 ENABLE
PORT 3 MODE PNTOPN
PORT 1 SENDMAFST ENABLE
PORT 1,3,5 LEARNSIDS ENABLE
PORT 3,5 PASSLINKI TXPORT 1
PORT 1 PASSLINKI TXPORT 3,5
PORT 3,5 PASSAPP ALL TXPORT 1
PORT 1 PASSAPP ALL TXPORT 3,5
SAVEDB
```

I-HUB B
```
CLEARDB
IHUB SID 200
IHUB NETMAFTX ENABLE
IHUB NETMAFTX 20 10
IHUB BCASTIHUBSTATUS ENABLE
PORT 1-2 BAUD 57600
PORT 1-2 MODE RING
PORT 5 ENABLE
PORT 5 SENDMAFST ENABLE
PORT 1,5 LEARNSIDS ENABLE
PORT 1,5 PASSLINKI TXPORT 1,5
PORT 1,5 PASSAPP ALL TXPORT 1,5
SAVEDB
```

4.2.6 I-HUB MAF, EVENT TRANSMISSIONS

An I-HUB may transmit its own Link Integrity, MAF status and events on some or all of its ports. Other I-HUBs in the system that are required to pass these messages on must be configured with the appropriate commands. An I-HUB must be configured with its own unique SID address when sending Link Integrity, MAF status and events – it cannot 'borrow' the SID of an *MX1* fire panel.

The MAF status sent by an I-HUB indicates fault conditions actually within the I-HUB with the exception of the PTT input signal, which if used, is generated by the external power supply indicating a power supply fault.

Fault conditions are also reported in the I-HUB status message. Currently only other I-HUBs with V2.00 or later firmware and *MX1* fire panels are able to interpret I-HUB status messages. This message is part of the system monitor application, for remote fire panels and I-HUBs to receive the message this application must be passed through.

An I-HUB installed in an *MX1* fire panel should be monitored by that panel through I-HUB status messages. The status will be reported on the 241.32.x *MX1* Controller points.

Otherwise the I-HUB MAF status can be monitored by another network device, such as an F3200/F4000/MX4428/*MX1* fire panel, NDU etc, that is able to annunciate the fault. Remote *MX1* fire panels should monitor the MAF and I-HUB status. The I-HUB status is used to give more detailed information on the condition of the I-HUB.

An I-HUB is able to operate as the I-HUB fault master for all I-HUBs that are not monitored locally by *MX1* fire panels. It will combine their I-HUB status into its own MAF status and send that for monitoring by another device. See the `IHUB IHUBFLTMASTER` command documented in Section 5.7 for enabling this functionality.

An I-HUB can also monitor locally connected PIBs for both local and remote PIB faults. These faults are reported as part of the I-HUB status and are also combined into the NETFLT MAF status. See the `IHUB SIGNALLOCALPIBFLTS` and `IHUB PIBFLTMASTER` commands documented in Section 5.7 for enabling this functionality.

Fault indicators included in the I-HUB's MAF status are:

SYSFLT When this is in the MAF status without PSUflt or NETFLT it indicates that a fault is present that is not a network related fault or a power supply fault. When those other faults are present, this status may just be used to place a receiving panel into an off-normal state. The I-HUB diagnostic terminal should be used to obtain more detailed fault information.

Abnml This occurs when any other MAF status indication present is for a fault. Its presence is used to indicate that the status is abnormal.

PSUflt PTT signal has been activated by the I-HUB power supply. Refer to Section 3.1.4 for connection.

NETFLT This occurs if there is a network related fault present. The I-HUB diagnostic terminal should be used to obtain more detailed fault information.

SysFRcl This occurs if a warning is present. The I-HUB diagnostic terminal should be used to obtain more detailed information.

All of the above indications are non-latching and will clear when the condition causing them clears.

The parallel I/O connector (J3) of the I-HUB has pin 1 as an active high output. It will become low when the SYSFLT MAF status indicator is asserted. This is useful to signal fault to devices such as QE20/QE90 that don't understand MAF status. For this to work, the I-HUB must have NETMAFTX enabled i.e. the I-HUB must have the following.
`IHUB NETMAFTX ENABLE`

The sending of MAF status on a port is controlled by the SENDMAFST option.
`PORT x SENDMAFST DISABLE`

The I-HUB will also transmit the following event messages (event application) that can be printed or logged by network devices such as the F3200/NDU, NLDU, *MX1* or PTM (not F4000/MX4428).

SID nnn I-HUB STARTUP <version> This event occurs when the I-HUB powers up or re-starts.

SID nnn I-HUB QUEUE X WARNING This event occurs when network queue x has reached a warning level. Refer also to the `SET PLINK PORT n QUEUE` programming command.

SID nnn I-HUB QUEUE X FULL This event occurs when network queue x has become full and messages have been discarded.

4.2.7 ACKNOWLEDGING OF BROADCASTS

Many devices in a Panel-Link network use the 'broadcast' message format to indicate their status. Rather than send a status message to multiple individual devices (in some networks a large number of FIPs may be monitoring the status of a device), the broadcast method is used. A broadcast message is sent out on the network to any device programmed to receive it. FIPs that are interested in a particular status that is included in a broadcast message can be programmed to accept (and possibly display) the status from a list of SID(s). But for multi-drop networks, on each physical network segment one device only should be configured to "acknowledge broadcasts", i.e. to send a message back to the sender to indicate that the broadcast has been received.

To program an I-HUB to acknowledge all broadcasts received on a particular port the `PORT X ACKBCAST ENABLE` command is used, where X is the port number on which the I-HUB is to send the acknowledgement, e.g. `PORT 3 ACKBCAST ENABLE.`

When the I-HUB is acknowledging broadcasts on one particular network segment, it is desirable that another device on that network segment is configured to acknowledge the broadcast messages being sent by the I-HUB(s). This means that such a device must be configured to specifically acknowledge broadcast messages sent by the I-HUB but not to acknowledge broadcasts sent by any other device.

Network devices which are able to do this include QE90, NDU, NLDU, F3200 and the I-HUB itself.

To program an I-HUB to acknowledge the broadcast messages sent by a particular network device, n, use the command:

```
SID n ACKBCAPP ALL
```

4.3 SPECIFIC NETWORK CONFIGURATIONS

4.3.1 EXAMPLE 1: RING MODE

A network may contain multiple I-HUBs connected in a ring as shown in Figure 4.3.1. Ring networking offers an extra level of redundancy over multi-drop and point-to-point modes. In ring mode, ports 1 and 2 are used as the "ring ports".
Messages are sent by the I-HUB in opposing directions around the ring. If a fault (open/short circuit) occurs in one of the ring segment wiring then no devices are disconnected. Furthermore if a single I-HUB develops a fault then only the devices that are connected to the non ring ports are disconnected. The rest of the devices in the remaining section of the ring will continue to operate.

Currently, up to 64 I-HUBs can be supported in a ring network at speeds up to 57,600 bits per second. When operating in ring mode all segments of the ring should operate at the same speed to prevent data bottlenecks.

Ring mode also supports the networking of I-HUBs via specific fibre optic converters. Fibre optic converters convert the I-HUB ports 1 and 2 from RS485 to fibre optic signals.

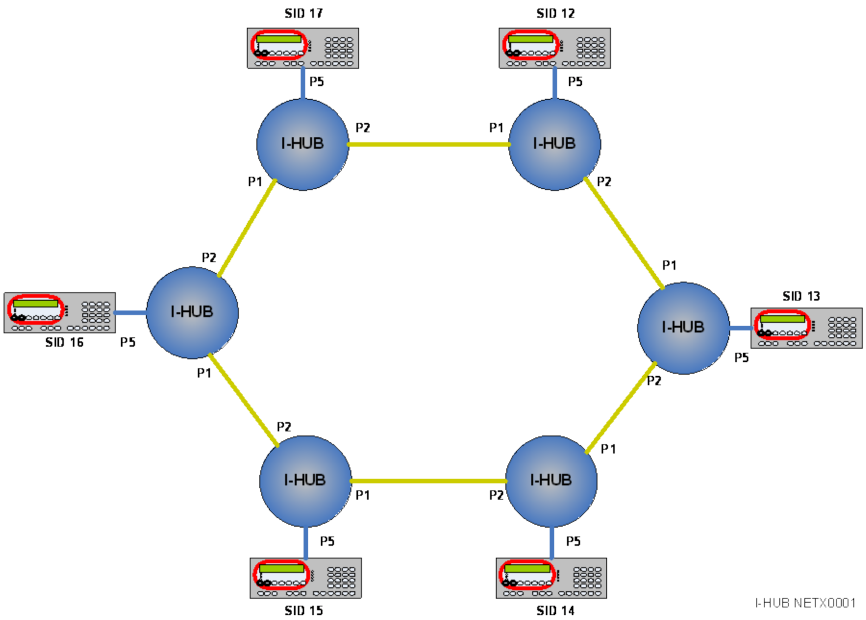


Figure 4.3.1 – Network Ring Mode

In ring mode, transmit and receive LEDs for ports 1 and 2 will appear to glow almost continuously. If they are "flicking" briefly a few times a second, this indicates a faulty connection.

Section 5.8.1 "Example 1: RING Network" in this document, deals with the I-HUB configuration settings necessary for ring mode networks.

4.3.2 EXAMPLE 2: SINGLE I-HUB WITH TWO NETWORK PORTS

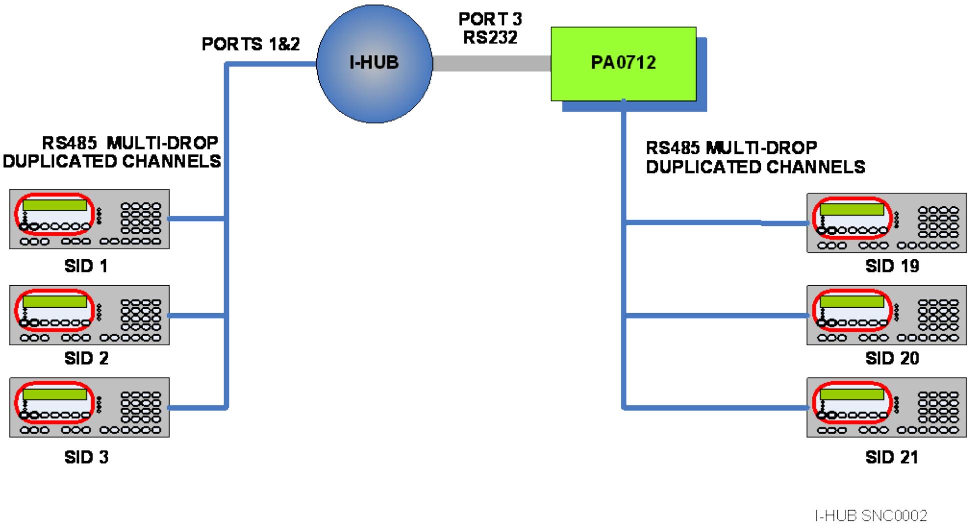


Figure 4.3.2 – Single I-HUB, Two Network Ports

In this example, two RS485 multi-drop network segments are connected by the I-HUB. Each of the devices on the two network segments can be configured as if all devices were on the same network segment, with the possible exception of Link Integrity monitoring (refer to the PASSLINKI command).

The I-HUB must be configured with appropriate commands according to what information needs to be passed between the two network segments.

Ports 1 and 3 in the I-HUB would both be configured as multi-drop, i.e.

```
PORT 1 MODE MULTIDROP
PORT 3 MODE MULTIDROP
```

With SID 1 on port 1 and SID 21 on port 3 the I-HUB would be configured with:

```
SID 1 PORT 1
SID 1 PASSAPP ALL TXPORT 3
SID 1 PASSLINKI TXPORT 3
SID 21 PORT 3
SID 21 PASSAPP ALL TXPORT 1
SID 21 PASSLINKI TXPORT 1
```

Similar commands will be needed for the other SIDs as required.

Depending on the size of the system, it may be necessary for the "PASSAPP ALL" commands to be replaced with "PASSAPP a,b,c" type commands to reduce the number of messages being passed on by the I-HUB. Also depending on the size of the system it may be desirable to avoid passing Link Integrity messages through the I-HUB (refer Section 4.2).

4.3.3 EXAMPLE 3: SINGLE I-HUB WITH FOUR NETWORK PORTS

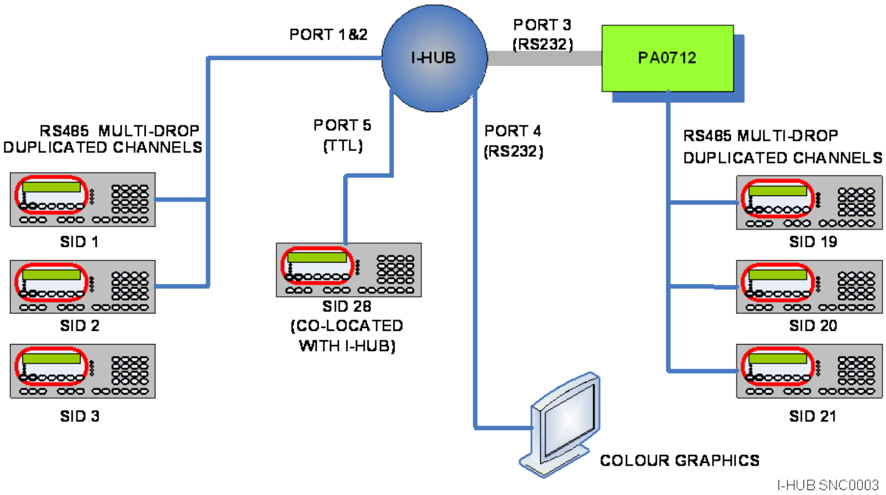


Figure 4.3.3 – Single I-HUB, Four Network Ports

In this example, all of the four network ports available in an I-HUB are in use. Ports 1 and 3 are multi-drop RS485 with duplicated channels and would be configured with:

```
PORT 1 MODE MULTIDROP
PORT 3 MODE MULTIDROP
```

Ports 4 and 5 would be configured in point-to-point mode:

```
PORT 4 MODE PNTOPN
PORT 5 MODE PNTOPN
```

The I-HUB may be configured with appropriate "PASSAPP" commands to pass information from all the network devices on ports 1, 3 and 5 to the colour graphics device on port 4.

4.3.4 EXAMPLE 4: INCREASING THE NUMBER OF PORTS

If the four network ports of a single I-HUB are not enough in an application where a number of FIPs and other equipment are to be networked together, then two or more I-HUBs can be linked to provide more network ports.

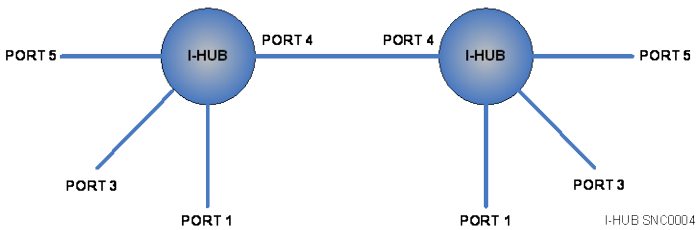


Figure 4.3.4 – Interconnecting two I-HUBs

Figure 4.3.4 shows one method of interconnecting two I-HUBs in a co-located situation. Alternatively Port 5 on one I-HUB could be interconnected to port 5 on the other I-HUB. The ultimate decision of which ports to use will be determined by what interfaces are available on the FIP equipment that will connect to the I-HUBs.

A configuration of two I-HUBs such as this may also be needed to connect two network segments that have large physical separations by linking the two I-HUBs using the RS485 ports 1 and 2. While any of the four network ports could be used to connect the two I-HUBs, it is preferable to use RS485 ports 1 and 2 depending on the requirements of a particular configuration.

The amount of data passed from one network port to another and between the two I-HUBs should be minimised with appropriate `PASSLINKI` and `PASSAPP` commands

4.3.5 QE20

Fire panels with an I-HIB may be connected to the same RS485 ring network as QE20 panels, optionally so that fire alarm information can be sent to the QE20 and fault status received.

No special programming of the I-HUB or QE20 panels are required to operate on the same network, However, if the fire panel is to send alarm information to the QE20 then the panel and QE20 will need to be programmed for the relevant information. Refer to the appropriate panel and QE20 Design Manuals.

Note the I-HUB currently does not support the QE20 Clock Sync message, so cannot be included on QE20 networks if synchronisation is required between QE20 panels on the network.

5 PROGRAMMING

5.1 CONNECTION FOR PROGRAMMING

Port 4 (RS232 Port B J6) is the serial port used for I-HUB programming. The supplied cable (LM0065) with a 10-way FRC and DB9 connector is used and the wiring for this is shown in Section 3.2.

A terminal program that supports ANSI terminal emulation should be used on the PC. Suitable programs are SmartConfig Terminal, WinComms, and HyperTerminal.

In programming mode the port operates at 9600 baud, 8 data bits, no parity, one stop bit.

5.2 ENTERING PROGRAMMING MODE

There are two ways of entering programming mode:

1. From power down, power up the I-HUB and enter **eee** (lower case) within 10 seconds. The message

   ```
   "I-HUB Programming Mode"
   ```

   will appear after 10 seconds together with the "`I-HUB>`" prompt. At this point the I-HUB is ready to accept commands. When the I-HUB is in programming mode, all message processing is stopped.

2. From the Runtime Diagnostic mode, enter G. A prompt will then appear.

   ```
   I-HUB DIAG> g

   About to enter programming mode - this will take the I-HUB
   offline.

   Type 'YES', then <Enter> to confirm:
   ```

   Type YES (caps are not required) at the prompt then Enter: the I-HUB will then go into programming mode.

If the message:

```
Corrupt or no existing database
```

Appears at start-up and the I-HUB automatically enters programming mode, then the site-specific data has been lost, corrupted or never entered (for example when a new EEPROM IC has been fitted) and so will need to be cleared with the CLEARDB command, and then re-entered.

This could occur if the I-HUB has not been initialised or configured previously. If the error is unexpected, try powering the I-HUB down and up again before doing the CLEARDB command.

To clear/ reinitialise the site-specific data for the first time enter the following command:

`CLEARDB` - clears RAM based site-specific data

5.3 PROGRAMMING THE I-HUB

The I-HUB has two site-specific data storage areas. Non-volatile Memory (EEPROM) is used for permanent storage, and volatile memory (RAM) for configuration and for runtime operation.

On power up, the I-HUB checks the EEPROM for correctness and loads its contents into RAM. All subsequent programming is made on the RAM copy, including clearing the site-specific data (`CLEARDB` command). Once programming is complete, the new site-specific data must be copied from RAM to EEPROM using the SAVEDB command. Note the EEPROM must be write enabled with LK4 fitted as shown in Figure 5.3.1.

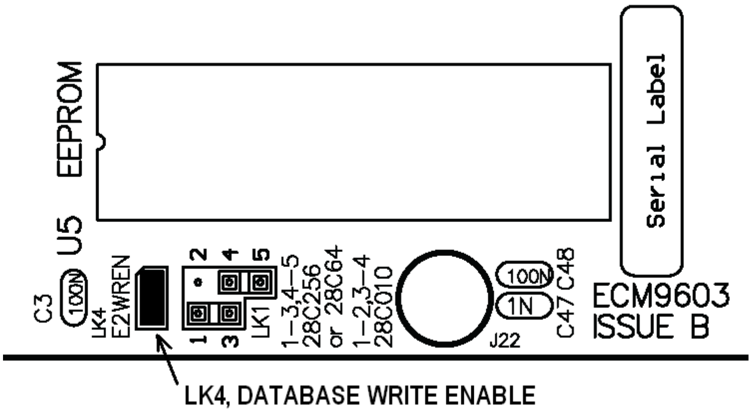


Figure 5.3.1 – LK4 Write Enable Link Location

At any stage during programming, the existing EEPROM contents can be re-loaded to RAM by using the `RELOADDB` command. If a `SAVEDB` command is executed, any subsequent `RELOADDB` command will reload the site-specific data saved by the most recent `SAVEDB` command. Saving the RAM site-specific data to EEPROM requires that the I-HUB write enable link LK4 be fitted before the `SAVEDB` command is executed. It should be removed when all configuration and programming is completed.

The I-HUB prompts for commands with an "`I-HUB>`" prompt.

Programming commands are entered one command per line, e.g.

```
      I-HUB> PORT 1 BAUD 9600
```

using the command definitions described in this document. When the command has been executed, the prompt is displayed again.

Some commands make changes to the site-specific data, and others display the site-specific data. This facilitates the saving and restoration of the site-specific data - the captured "display" information can be downloaded to an I-HUB to configure that I-HUB. Alternatively, a complete I-HUB configuration can be entered and edited in a text file, which is then downloaded to the I-HUB to configure it.

To help maintain the configuration text file, comments can be added. A comment on any line of input starts at the first ";" character - all text on the line following the ";" character is ignored by the I-HUB, for example:

```
I-HUB> ; this is a comment line
I-HUB> PORT 3 BAUD 19200 ; Comment following command
```

If the I-HUB finds a problem in the command, it will generate an error message. Some error messages are specific to particular commands. There are also a number of "common" error messages, as follows:

"**Error in command format**"
Indicates that the command was incomplete or had unexpected information present.

"**Illegal command**"
The entered command is invalid and/or unknown.

"**Error in expected data entry**"
The entered command has the wrong type of data, invalid data, or insufficient data.

5.3.1 CREATING A NEW SITE-SPECIFIC DATA FILE ON A PC

To create a data file on a PC with a text editor, the first command should be `CLEARDB`. For simple defaults the second command should be `MX1DEFAULTS`. The data file should end with the `SAVEDB` command.

`CLEARDB` sets the configuration to a certain set of defaults. These can be viewed in the programming mode with the `DISPLAY DEFAULTS` command. The defaults that make up the `MX1DEFAULTS` command will also be displayed here. These are also listed in Section 5.8.

Sometimes it may be easiest to copy an existing site-specific data file and modify it as necessary.

5.4 EXITING PROGRAMMING MODE

There are 3 ways to exit programming mode:

i. Enter "`EXIT`" at the I-HUB prompt:
   - if no changes have been made since the last `SAVEDB` command, the I-HUB will restart and if it has a valid configuration, enter Run mode.
   - If changes have been made since the last `SAVEDB` command, the I-HUB prompts whether to discard all changes. If "YES" is entered, the I-HUB will discard the changes and restart, if it has a valid configuration it will enter Run mode. If any other entry is made, the I-HUB will re-display the command prompt.

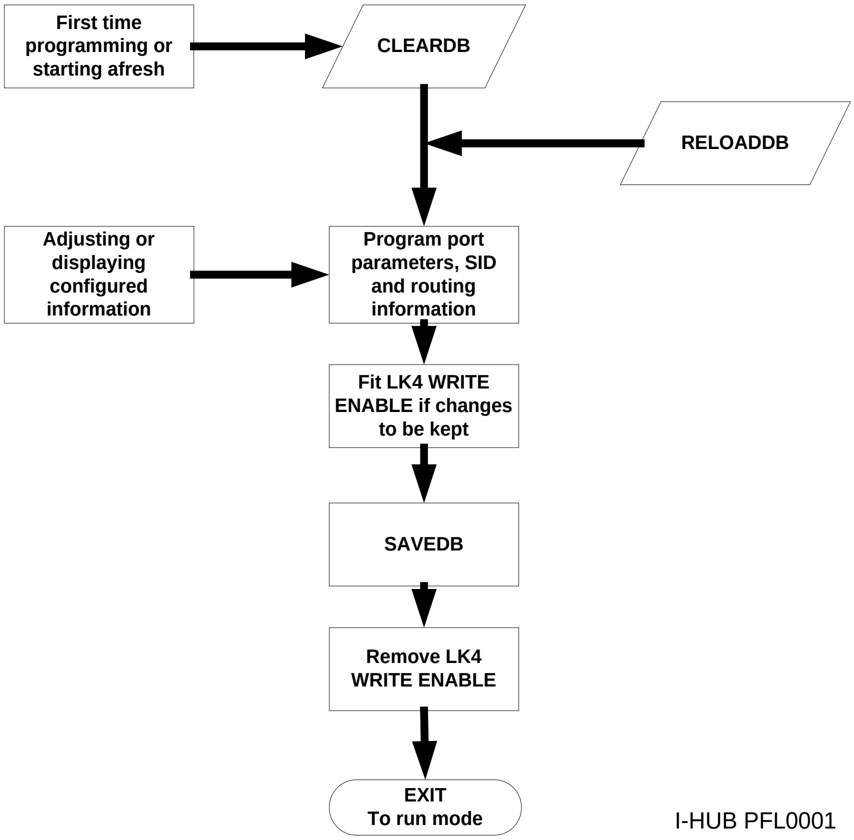
ii. Programming Terminal Inactivity: - if no site-specific data changes have been made since the last `SAVEDB` command, and no key presses are detected by I-HUB for 10 minutes, the I-HUB will automatically restart and if it has a valid configuration, enter Run mode.

iii. Turning power off and on again, or otherwise resetting the I-HUB microprocessor will cause programming mode to be aborted and all changes will be lost (not recommended).

Note: Always remove Link 4 EEPROM WRITE ENABLE after the `SAVEDB` command has completed and prior to exiting programming mode.

5.5 ORDER OF PROGRAMMING COMMANDS

The following diagram shows the programming procedure.



5.6 RANGE / LIST ENTRY

Many of the commands can be applied across a list and/or range of SIDs or ports, all with a single command. Where the command format below indicates "list/range", a comma separated list of numbers and/or ranges is supported. All of the following would be acceptable:

3
3,5
3-5
3-5,1

Each of the PORT and SID commands allow the ports or SIDs to be specified in this manner.

Also, "A" and "B" may be used as aliases for ports 3 and 4.

5.7 PROGRAMMING COMMANDS SUMMARY

There are four groups of programming commands, as shown in the tables below.

Where the text "ENABLE | DISABLE" appears in the command, this means that either "ENABLE" or "DISABLE" may be placed in this position. This will enable or disable the option respectively.

Site-specific data manipulation commands

Command	Action
CLEARDB	Re-initialises RAM site-specific data to defaults.
MX1DEFAULTS MX1-MULTIDROP MX4428-RING MX4428-MULTIDROP	Quick configuration commands for common cases..
SAVEDB	Copies RAM site-specific data to non-volatile EEPROM.
RELOADDB	Re-loads site-specific data from EEPROM into RAM.
DISPLAY	Displays current RAM site-specific data.
DISPLAY DEFAULTS	Displays default settings that CLEARDB and the "quick configuration" commands (MX1DEFAULTS etc.) will set the site-specific data to.

Global I-HUB Commands

Command	Action
IHUB SID nnn	Sets I-HUB SID number. I-HUB uses SID nnn.
IHUB SID NONE	Sets the I-HUB to have no SID of its own. Instead it will attempt to "borrow" the SID of the device connected on port 5.
IHUB NETMAFTX ENABLE	I-HUB transmits MAF status.
IHUB NETMAFTX DISABLE	I-HUB does not transmit MAF status.
IHUB NETMAFTX 20 10	Sets rate of transmission of I-HUB MAF status.
IHUB IHUBFLTMASTER ENABLE	I-HUB becomes the fault master for I-HUBs that don't have a local panel reporting their faults. Their status is combined into this I-HUB's MAF status for reporting to a panel monitoring the MAF status.
IHUB IHUBFLTMASTER DISABLE	I-HUB is not an I-HUB fault master.
IHUB SIGNALLOCALPIBFLTS ENABLE	Forces the I-HUB to inform connected PIBs that it will report local PIB status for them, thereby making the PIB send this status to the I-HUB.
IHUB SIGNALLOCALPIBFLTS DISABLE	I-HUB is not forced to inform connected PIBs that it will report local PIB status for them. With a directly connected panel that can do this (e.g. *MX1*), I-HUB will inform them regardless of this setting.
IHUB PIBFLTMASTER ENABLE	Forces the I-HUB to inform connected PIBs that it will report remote PIB status for them, thereby making the local PIB send this to the I-HUB.
IHUB PIBFLTMASTER DISABLE	I-HUB is not forced to inform connected PIBs that it will report remote PIB status for them. If a directly connected panel (e.g. *MX1*) is configured to be the PIB fault master, the I-HUB will inform them regardless of this setting.

Route & Filter Commands

Command	Action
SID list/range PORT p	Maps SID n to PORT p.
PORT list/range LEARNSIDS ENABLE | DISABLE	Enables or disables automatic learning of which SIDs are located on the specified port(s).
SID list/range NOWHERE	Don't route messages destined to this SID anywhere.
PORT list/range PASSLINKI TXPORT list/range	Pass Link Integrity messages from specified port(s) to the specified port(s).
SID list/range PASSLINKI TXPORT list/range	Pass Link Integrity messages from specified SID(s) to the specified port(s).
PORT list/range PASSLINKI NOWHERE	Don't pass Link Integrity from the specified port(s) anywhere.
SID list/range PASSLINKI NOWHERE	Don't pass Link Integrity from the specified SID(s) anywhere.
PORT list/range PASSAPP ALL TXPORT list/range	Pass all application messages from specified port(s) to the specified port(s).
PORT list/range PASSAPP a,b,c TXPORT list/range	Pass specified application messages from specified port(s) to the specified port(s).
SID list/range PASSAPP ALL TXPORT list/range	Pass all application messages from specified SID(s) to the specified port(s).
SID list/range PASSAPP a,b,c TXPORT list/range	Pass specified application messages from specified SID(s) to the specified port(s).
PORT list/range PASSAPP ALL NOWHERE	Don't pass application messages from the specified port(s) anywhere.
SID list/range PASSAPP ALL NOWHERE	Don't pass application messages from the specified SID(s) anywhere.
SID list/range ACKBCAPP ALL	Ack all broadcast messages from the specified SID(s).

Physical Port Commands

Command	Action
PORT list/range ENABLE | DISABLE	Enables or disables specified port(s).
PORT list/range MODE X	Sets the port(s) connection mode.
PORT list/range BAUD rrrrr	Sets the baud rate for specified port(s).
PORT list/range RXTIME t	For multi-drop mode sets the dwell time before transmitting a message on the specified port(s).
PORT list/range TXDELAY t	For multi-drop mode sets the transmit slot time on the specified port(s).
PORT list/range ACKTIME t	Sets the time I-HUB waits for an ACK before resending on the specified port(s).
PORT list/range DUPTIME t	For multi-drop mode sets the window in within the reception of the same message is considered a duplicate on the specified port(s).
PORT list/range LEADFF v	Sets the number of framing characters sent at the start of a message on the specified port(s).
PORT list/range TRAILFF v	Sets the number of framing characters sent at the end of a message on the specified port(s).
PORT list/range LINKRX t	Sets the time within which at least one Link Integrity message must be received on the specified port(s).
PORT list/range LINKTX t	Sets the I-HUB Link Integrity transmit time on the specified port(s).
PORT list/range ROUTELIDELAY v	Sets the holding delay for grouping routed

	Link Integrity messages on the specified port(s).
PORT list/range RETRIES v	Sets the number of retransmissions of messages that are not acknowledged, for the specified ports.
PORT list/range EXPECTBCACK ENABLE | DISABLE	Enables/Disables the requirement for acknowledgment by the receiving device of the messages sent by the I-HUB on the specified port.
PORT list/range ACKBCAST ENABLE | DISABLE	Enables/Disables the I-HUB to acknowledge broadcast messages on the specified port(s).
PORT list/range CONCATMSG ENABLE | DISABLE	For multi-drop mode enables or disables the grouping/holding of routed messages on the specified port(s).
PORT list/range SENDMAFST ENABLE | DISABLE	Enables or disables the transmission of I-HUB MAF status on the specified port(s).
PORT list/range QUEUE x,y,z	Sets the QUEUE size (x), warning level (y), warning clear level (z) for the specified ports.
PORT list/range BCASTIHUBSTATUS ENABLE | DISABLE	Enables or disables sending of I-HUB status message on the specified port(s).
PORT list/range HIDEMSGDISCARD ENABLE | DISABLE	Enables or disables the concealment (they are hidden, and don't get reported) of message discards that may occur on the specified port(s).

5.7.1 SITE-SPECIFIC DATA COMMANDS

5.7.1.1 Initialising the Site-Specific Data - CLEARDB

The command `CLEARDB` is used to reset the site-specific data in RAM to defaults. This must always be done when programming/configuring an I-HUB for the first time. The site-specific data contents in non-volatile EEPROM will not be affected until a `SAVEDB` command is done.

5.7.1.2 Initialising the Site-Specific Data - MX1DEFAULTS

The command `MX1DEFAULTS` is used to add additional defaults for simple (*MX1*) networking to the site-specific database. With this command, and an *MX1* fire panel connected on port 5 and the I-HUB connected in a ring, no further configuration will be required for many applications. This is the default configuration that is provided out of the factory for I-HUBs installed with V2.00 firmware.

5.7.1.3 Saving the Site-Specific Data - SAVEDB

When changes are made to the site-specific data, the changes are initially done to the site-specific data in RAM. These changes must be saved to non-volatile EEPROM using the command `SAVEDB`. The EEPROM Write Enable Link LK4 must be fitted before the `SAVEDB` is entered, and removed once the command is complete.

5.7.1.4 Displaying & Backing Up the Site-Specific Data

The command `DISPLAY` may be used to display the text entered to create the site-specific configuration. The information is output in a format that can be captured on a PC to a file and used for reloading into the I-HUB at a later time. This is why the data is preceded by `CLEARDB` and followed by `SAVEDB`.

To load site-specific data into the I-HUB from a file on a PC, power up the I-HUB and enter programming mode. Enter the command `CLEARDB`. If the file being loaded was created by a `DISPLAY` command, then it is not necessary to enter the `CLEARDB` command as this is contained in the file itself. Transmit (send) the file from the PC. After the file has been transmitted by the PC, enter the command `SAVEDB` (if not already included in the file). If the file being loaded was created by a `DISPLAY` command, then it is not necessary to enter the `SAVEDB` command as this is contained in the file itself.

Some site-specific data is 'hidden' in that the `CLEARDB` and `MX1DEFAULTS` commands introduce some set defaults into the site-specific data. These are always the same however. This default data may be viewed with the `DISPLAY DEFAULTS` command.

5.7.1.5 The RELOADDB Command

The `RELOADDB` command copies the EEPROM site-specific data into RAM. This is done automatically whenever programming mode is entered. Any programming changes that have been made and not saved with a `SAVEDB` command will be lost.

5.7.2 GLOBAL I-HUB COMMANDS

IHUB SID nnn / NONE
This command sets the I-HUB SID number.

Alternatively a value of `NONE` may be specified – this will cause the I-HUB to not have a SID number of its own. The I-HUB will instead try to "borrow" the SID number of the device connected on port 5. Currently the *MX1* is the only device that allows its SID number to be borrowed, but other devices may support this functionality in the future.

The SID number of the device (*MX1*) connected on port 5 is unable to be borrowed in these scenarios:

- `IHUB NETMAFTX` is enabled.
- `IHUB IHUBFLTMASTER` is enabled.
- Link Integrity transmission is enabled.
- Ports 1 and 2 are not in ring mode, or any other ports apart from port 5 are enabled.

The I-HUB will not allow a database to be saved that attempts to borrow a SID number in those scenarios – `SAVEDB` will fail with an error message.

Borrowing the panel's SID number is useful as the I-HUB no longer needs its own SID number, and eases configuration as the same configuration may be used for most nodes in a single network.

By using `MX1DEFAULTS`, for many applications, no custom configuration will be required at all.

IHUB NETMAFTX ENABLE/DISABLE
This is a global command that enables or disables the transmission of the I-HUB's MAF status. If the I-HUB is to transmit its own MAF status then this command must specify ENABLE and the PORT(s) that the I-HUB is to transmit its MAF status on must be set via the `PORT list/range SENDMAFST ENABLE` command.

IHUB NETMAFTX 20 10
This command sets the refresh and change of state timing for the MAF status transmission. The first value sets the time period (seconds) between regular MAF status transmissions. The second value sets the maximum delay before a new MAF Status (as a result of a change of State) is transmitted. The first value could be increased to 30 or even 40 seconds on heavily loaded networks.

IHUB IHUBFLTMASTER ENABLE/DISABLE
This is a global command that enables or disables the I-HUB to operate as a fault master for other I-HUBs that don't have their status monitored by a connected device. The option `PORT list/range SENDMAFST ENABLE` must be enabled for this to operate, but `IHUB NETMAFTX ENABLE` is not required.

IHUB SIGNALLOCALPIBFLTS ENABLE/DISABLE
This is a global command that enables or disables forcing of the I-HUB to indicate to connected PIBs that it can signal their local faults. When disabled, if the I-HUB has a directly connected panel (e.g. *MX1*) that supports reporting local PIB status, it will indicate that it can signal local PIB status regardless of this setting. Refer to the PIB User manual LT0519 Issue 3.00 or later for detail on the signalling of PIB faults.

IHUB PIBFLTMASTER ENABLE/DISABLE
This is a global command that enables or disables forcing of the I-HUB to indicate to connected PIBs that it can signal remote PIB faults. When disabled, if the I-HUB has a directly connected panel (e.g. *MX1*) that is configured as PIB fault master, the I-HUB indicates that it can signal remote PIB faults regardless of this setting. Refer to the PIB User manual LT0519 Issue 3.00 or later for detail on the signalling of PIB faults.

5.7.3 PROGRAMMING NETWORK PORTS

I-HUB Ports which are not to be used should be disabled, i.e., include the command `PORT list/range DISABLE` to disable the port.

Port 4 is always considered as the programming port. As mentioned elsewhere in this document, port 4 should not be used as a network port if possible. If port 4 must be used as a network port, then complete and save all other network configuration settings before enabling and connecting the port to a network.

Note that the 'network' parameter settings for port 4 do not affect the operation of this port when in program mode. Refer to Sections 5.1 and 5.2 for programming mode set up.

Ports 1 and 2 are normally operated as a combined port with duplicated channels or as ring-mode ports. The parameters for this are configured for port number 1 with port number 2 disabled.

```
PORT 1 ENABLE
PORT 2 DISABLE
```

In ring mode, while port 2 is normally disabled, the parameters for port 2 (e.g. baud rate) should be configured to be the same rate as port 1.

5.7.3.1 Physical Port Parameter Details

The meaning of each network parameter is explained here. The default settings for each port are shown in Section 5.7. Note that each port may have slightly different default settings.

PORT list/range [ENABLE/DISABLE]

When port(s) are to be used as a network port then the command `PORT list/range ENABLE` must be issued. To reduce processing overhead on the I-HUB, disable all unused network ports by issuing the command `PORT list/range DISABLE`.

PORT list/range MODE m

This command specifies the networking type for the specified port(s). The following 'modes' are supported:

MULTIDROP	= half duplex channel with collision detection.
PNTOPN	= point-to-point, full duplex with RTS always on.
PNTOPNRTSC	= point-to-point full duplex with RTS on only while transmitting and toggling to do channel (A, B or both) selection.
RING	= Ring mode RS485 half duplex (applies only to ports 1 and 2)

PORT list/range BAUD r

Parameter r is the port(s) baud rate and must match that of the connected equipment.

Ports 1, 2 and 5 allow any value, 300 to 57600 (any rate is enterable – this must match the device, higher than 57600 should be used only on the recommendation of a JCI engineer).

Ports 3 and 4 are limited to 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400.

Note when setting the baud rate for ports 3 and 4 (RS232 A and B), if one of these ports is set to 19200 then the other may not be set to 38400.

PORT list/range RXTIME t

RXTIME is used in multi-drop half-duplex modes. RXTIME is the minimum delay after receiving any character before the I-HUB will start a transmission. RXTIME = 1-255 in units of 3 milliseconds.

The default value of 2 gives 6 milliseconds, which is suitable for 4800, 9600 or 19200 baud RS485 half duplex. When using multi-drop half duplex modes with 1200 baud modems a value of 8 should be used (24 milliseconds) which is long enough to ensure that another device which has just completed transmitting is ready to receive.

PORT list/range TXDELAY d

This parameter is used in multi-drop half-duplex modes, where it sets the transmit slot width 'd' (1-255) in units of 3 milliseconds. There are 8 slots. The default of 1 sets 3 milliseconds, giving a start transmit time range of 8 (slots) times 3 milliseconds = 24 milliseconds which is suitable for 4800, 9600 or 19200 baud RS485 contention. For multi-drop with 1200 baud modems a value of 8 should be used. This gives a start transmit time range of 8 times 3 times 8 = 192 milliseconds. For 1200 baud multi-drop modems the rxtime and txdelay parameters result in an average 'turnaround' delay of 192/2+24 = 120 milliseconds.

PORT list/range ACKTIME t
This parameter sets the maximum time the I-HUB will wait for an acknowledge after transmitting a message, before re-sending the message. The value t (1-255) is in units of 65 milliseconds. The default value of 13, giving 0.8 seconds, is suitable for 4800, 9600, 19200 baud RS485.

When modems are used, the value to set for ACKTIME must allow for any delay added by the modem itself. For 1200 baud multi-drop using VIGILANT PA0464 or PA0468 modems a value of 45 should be used giving a time of 2.9 seconds.

For 1200 baud modems point-to-point using VIGILANT PA0464 or PA0468 modems a value of 24 should be used giving a time of 1.5 seconds. For further information on using modems with I-HUB refer to the appendix section 8.4 "Using Modems with I-HUB".

NOTE 1: The above times assume that all the devices involved are VIGILANT devices (QE20/QE90, F3200, F4000, I-HUB, *MX1*) etc. which are all able to respond (i.e. send an ack) to a message requiring an acknowledge within 200 milliseconds and nominally within 100 milliseconds. For non-VIGILANT devices, if the response time is longer than 200 milliseconds then the difference must be added to the value set for ACKTIME.

NOTE 2: The value of the DUPTIME parameter (below) depends on the value of the ACKTIME parameter so that when a message is retransmitted due to an ACK not being received, the second message can be recognised as a duplicate.

NOTE 3: If the device from which the ack was expected has failed i.e. no ack was received after all retries, then for future transmissions, when waiting for an ACK, the I-HUB will not wait the full amount of 'ack wait time' (so as not to hold up other messages), but if an ack does arrive (however late), the I-HUB will recognise this and will resume waiting the full amount of 'ack wait time'.

PORT list/range DUPTIME t
For multi-drop half duplex modes, this parameter sets the time within which the reception of the same message will be recognised as a 'duplicate' message and not processed twice. The value t (1-255) is in units of 33 milliseconds and the default value of 40 sets a time of 1.3 seconds.

NOTE 1: As mentioned in note 2 of the ACKTIME parameter, the DUPTIME parameter must match the ACKTIME parameter. Also mentioned in note 1 of the ACKTIME parameter, any value that is added to the ACKTIME to allow for a receiver processing delay, must also be added to the DUPTIME parameter. E.g. if 260 milliseconds (value 4) is added to the ACKTIME parameter, then 260 milliseconds (value 8), should be added to DUPTIME - HOWEVER, the resolution on the DUPTIME parameter is 325 milliseconds, so an additional 325 milliseconds should be added to the DUPTIME parameter (260+325=585 requiring a value of 18 (585/33) being added to DUPTIME when 260 milliseconds is added to ACKTIME).

PORT list/range LEADFF v
The value v (1-255) sets the number of leading 'framing characters' that are transmitted at the start of every message. The default value is 1.

PORT list/range TRAILFF v
The value v (1-255) sets the number of trailing 'framing characters' that are transmitted at the end of every message. The default value is 1.

PORT list/range LINKRX t
This parameter sets the time t in seconds (1-255) within which at least one Link Integrity message must be received on each channel for any device that is configured to be on this port or a Link Integrity 'fault' will occur. The default value is 50 seconds.

The I-HUB monitors reception of Link Integrity for all configured SIDs but the information is used for diagnostic purposes only and can be displayed on the diagnostic terminal.

PORT list/range LINKTX t
This parameter sets the time t in seconds (0-255) between the I-HUB transmitting its own Link Integrity messages onto this port. Other devices can be configured to expect to receive Link Integrity messages from the I-HUB and will generate a fault if they don't receive them. The default value is 0, which means the I-HUB will not transmit its own Link Integrity. If Link Integrity is to be transmitted then 15 seconds is the value normally used, but may be higher on large, well performing networks.

PORT list/range ROUTELIDELAY t
To improve the efficiency of the network, the I-HUB attempts to transmit Link Integrity messages in groups and will delay passing on some Link Integrity messages until it has enough messages to form a group. ROUTELIDELAY is a value in seconds which sets the maximum time that the I-HUB delays transmitting a 'routed' Link Integrity message. The default value for this parameter is 4 seconds. For a port using PNTOPN or PNTOPNRTSC mode, in some situations, this parameter may need to be set to zero. If the parameter 'CONCATMSG' is set to DISABLE for this port then this parameter (ROUTELIDELAY) should be set to zero.

PORT list/range RETRIES r
This parameter sets the number of retries r (1-255) to be attempted after a transmitted message goes un-acknowledged for non-ring ports. The default value is 4. Once the retries are exhausted the acknowledging device is failed, any further messages will not be retried.

PORT list/range EXPECTBCACK [ENABLE/DISABLE]
This parameter should be set to ENABLE if the I-HUB should expect an ack to the broadcast messages it transmits on this port. Refer to section 4.2.7 Acknowledging of broadcasts.

PORT list/range ACKBCAST [ENABLE/DISABLE]
This parameter should be set to ENABLE if the I-HUB should ack ALL broadcasts received on the specified port(s) for all SIDs. Refer to section 4.2.7 Acknowledging of broadcasts.

In most situations, the I-HUB should be configured to acknowledge all broadcasts on a Panel-Link network segment (i.e. the ACKBCAST parameter is set to ENABLE). If possible, one other device on each network segment should be configured to acknowledge the broadcast messages transmitted by the I-HUB and the I-HUB should then have 'EXPECTBCACK ENABLE' set for this port.

When two I-HUBs are connected in point-to-point mode, they should both have 'EXPECTBCACK' and 'ACKBCAST' set to ENABLE for the port connecting them.

PORT list/range CONCATMSG [ENABLE/DISABLE]
When this parameter is set to ENABLE, the I-HUB will attempt to group messages together for transmission to improve the efficiency of the network. The default value is ENABLE. If this parameter is set to DISABLE then the ROUTELIDELAY parameter should be set to zero.

PORT list/range SENDMAFST [ENABLE/DISABLE]
When this parameter is set to ENABLE, the I-HUB will transmit its own 'MAF' status onto the specified port(s), but only if the 'global' I-HUB parameter 'NETMAFTX' is set to enable (IHUB NETMAFTX ENABLE). If the I-HUB detects a fault with its site-specific data in EEPROM, it indicates a system fault in its MAF status data and this can be monitored by another device on the network. Also, if one of the network transmission queues becomes full or exceeds the warning level then the I-HUB will set flags in the MAF status it transmits.

PORT list/range QUEUE x,y,z
Parameters x,y and z are numerical values where x is the queue size (in bytes), y is the warning level (in bytes), and z is the 'warning clear' level for the main transmit queue for the specified port(s). When the amount of data waiting in the queue gets to the warning level, a "queue warning" event is generated which other network devices can log. An indication is given on the diagnostic terminal. When the queue becomes full a "queue full" event is generated and system fault signalled to other network devices. The third parameter, z, sets the point at which the 'queue warning' and 'queue full' status are cleared. After a queue warning event has occurred, a further queue warning event will not be generated until the amount of data waiting in the queue has fallen below the warning clear point and then gone back up above the warning level.

If the warning level is set to zero, no warning event will be generated. If the warning clear level is zero, then no queue full event or system fault will be generated when the queue becomes full.

The default value for the queue size (for all ports) is 8000 bytes, the default for the warning level is 6000 and the default for warning clear level is 2800 bytes.

PORT list/range BCASTIHUBSTATUS [ENABLE/DISABLE]
When this parameter is set to ENABLE, the I-HUB will transmit I-HUB status messages on the specified ports indicating its current status to other I-HUBs and other devices that can understand the I-HUB Status messages.

PORT list/range HIDEMSGDISCARD [ENABLE/DISABLE]
When this parameter is set to ENABLE, the I-HUB will never raise a message discard fault for the specified ports – the presence of message discards is hidden.

5.7.4 PROGRAMMING ROUTE & FILTER COMMANDS

Either the SID learning functionality (PORT LEARNSIDS) must be enabled, or the numbers of all SIDs in the system (or at least, the SIDs that the I-HUB must pass messages to or from) must be configured into the I-HUB with the `SID` command.

```
PORT list/range LEARNSIDS ENABLE / DISABLE
SID list/range PORT p
```

The PASSLINKI and PASSAPP routing commands may be applied on either a port or SID basis, they have the following formats. Note there are two 'formats' for the PASSAPP command.

```
PORT list/range PASSLINKI TXPORT a,b,c…
SID list/range PASSLINKI TXPORT a,b,c…
PORT list/range PASSAPP ALL TXPORT a,b,c…
SID list/range PASSAPP ALL TXPORT a,b,c…
PORT list/range PASSAPP a,b,c…TXPORT x,y,z…
SID list/range PASSAPP a,b,c…TXPORT x,y,z…
```

A matching SID routing entry will take precedence over a match port routing entry.

Using this, routing for a particular SID may be blocked with a NOWHERE command:

```
SID list/range NOWHERE
```

For the PASSAPP and PASSLINKI commands instead of TXPORT, NOWHERE may also be used to prevent routing anywhere.

The ACKBCAPP command is available on a per SID basis – its format is:

```
SID list/range ACKBCAPP ALL
```

There is also a command to disable a SID but this is normally used only for testing purposes and should never appear in a site-specific data file because the CLEARDB command sets all SIDs to disabled.

The SID disable command is:

```
SID list/range DISABLE
```

NOTE: It is not necessary to additionally specify TXPORT 2 when specifying TXPORTs in PASSAPP and PASSLINKI commands. Messages accepted for TXPORT 1 in RING based systems are automatically sent on TXPORT 2. Messages accepted for TXPORT 1 in Duplicated Channel modes (non Ring) are sent automatically by the I-HUB.

5.7.4.1 The SID PORT command

The I-HUB needs to know on which port a SID is located for several reasons, including:

1. Messages which are addressed to a particular SID (rather than broadcast) can be directed to the correct port by the I-HUB and the I-HUB will acknowledge the message to the device that the message was received from on behalf of the actual destination SID.

2. The I-HUB will reject Link Integrity messages received from a particular SID if they are received on any port other than the port the SID is configured to be on.

```
SID list/range PORT p
```

The location of SIDs must be explicitly specified to the I-HUB via the `SID list/range PORT p` command, or the PORT list/range LEARNSIDS ENABLE command used to instruct the I-HUB to listen to messages on the specified port and learn the SID of each sending device on that port. For this to work well the devices must be transmitting messages (e.g., Link Integrity, MAF status) regularly. There will be a delay at start-up before all the SIDs are learnt.

5.7.4.2 The LEARNSIDS command

```
PORT list/range LEARNSIDS ENABLE / DISABLE
```

Enabling this option for specified port(s) instructs the I-HUB to learn the SIDs of devices on the ports and so avoid the manual programming.

5.7.4.3 The PASSLINKI command

```
PORT list/range PASSLINKI TXPORT a,b,c…
SID list/range PASSLINKI TXPORT a,b,c…
```

This command results in Link Integrity messages received from the specified source port or SID being retransmitted on each of the specified destination ports a,b,c…

This allows devices that are not on the same network segment to monitor the 'on line' status of devices on other segments and to monitor the integrity of the communications channels.

To minimise network loading, minimum Link Integrity routing should be a strategy to use. For example, if SIDs 1, 2, 3, and 4 are located on one network segment and SID 5 on another then it may be acceptable for SID 1 to monitor the Link Integrity of SIDs 2, 3, 4 and to indicate any fault in its MAF status which would be processed by SID 5. Then only Link Integrity from SID 1 needs to be routed to the network segment of SID 5. The advantage of this approach is the reduction in network loading particularly for large systems. The disadvantage is that to precisely identify a fault, both SIDs 1 and 5 must be interrogated which may not be convenient. Possibly a system wide event printer or history logger might help in this situation.

In ring mode (with software version 2.00 or higher) Link Integrity messages for both channels are routed around the ring in both directions. To check the integrity of the ring, several devices connecting to different nodes of the ring should be configured to monitor each other's Link Integrity, and the nodes concerned configured to pass Link Integrity as required.

The diagnostics terminal on an I-HUB may be used to display the "Link Integrity status" (as seen by the I-HUB) of all the SIDs in the I-HUB site-specific data as well that of SIDs that have been learnt.

When an incoming message matches the source port for one routing configuration and the SID criteria for another, then the PASSLINKI command for the SID will take precedence over that for the source port.

For testing purposes, the `TXPORT a,b,c` part may be replaced with NONE to cancel any previous PASSLINKI command.

The `TXPORT a,b,c` part may also be replaced with NOWHERE to install explicit routing that the specified Link Integrity messages should not be routed. Generally this would be used in combination with the behaviour that a PASSLINKI entry for a SID takes precedence over an entry for a source port.

Refer to Section 4.2.3.3 for a further discussion of the concepts of Link Integrity Monitoring.

5.7.4.4 The ACKBCAPP command

```
SID list/range ACKBCAPP ALL
```

This command results in the I-HUB acknowledging all broadcast messages that it receives from the specified SID(s). This command may appear in the site-specific data file any number of times, each with different SID number(s). If the I-HUB is configured to acknowledge all broadcasts for particular port(s) (i.e. `PORT list/range ACKBCAST ENABLE`), then the ACKBCAPP command is redundant for those port(s).

The ACKBCAPP command is useful when the I-HUB is not configured to acknowledge all broadcasts for a particular port because it allows the I-HUB to ack broadcasts received from particular SIDs only. E.g. there may be another device (say SID xyz) on the port which is configured to ack all broadcasts, and thus the I-HUB can be configured to ack broadcast messages transmitted by SID xyz with the command:

```
SID xyz ACKBCAPP ALL
```

For testing purposes, the command:

```
SID list/range ACKBCAPP NONE
```

will cancel any previous ACKBCAPP ALL command for the specified SIDs.

5.7.4.5 The PASSAPP command

```
PORT list/range PASSAPP ALL TXPORT a,b,c…
SID list/range PASSAPP ALL TXPORT a,b,c…
PORT list/range PASSAPP a,b,c... TXPORT x,y,z…
SID list/range PASSAPP a,b,c... TXPORT x,y,z…
```

The PASSAPP command is used to select which types of Panel-Link broadcast messages (Applications) received from specified source ports or SIDs are passed (retransmitted) to which destination ports. Each Panel-Link application message contains a "Source Application Number" which identifies the category of data contained in the message. It is often necessary to limit the types of application messages that are passed from one port to another so that there is no unnecessary transmission of messages.

The PASSAPP commands shown above allow either all applications to be passed (routed) to the specified destination ports or only selected application numbers to be passed. Descriptive text may also be used in place of application numbers – see Table 5.7.1.

Specifying a list or range for the source ports or SIDs has the same effect as repeated individual PASSAPP commands for the members of that list or range. An allowance is made so that when a list/range specification is used for the source ports, that when ports overlap with those in the destination TXPORT port list, configurations that would loop messages back to the source are not actioned.

The site-specific data file may contain more than one PASSAPP command for the same source port or SID.

Multiple PASSAPP commands that specify a list of applications for the same destination port, but with the same source port or SID, will be combined.

However, there is a limitation that for a given destination port and source port or SID, PASSAPP ALL commands, and PASSAPP n commands that specify a list of applications, will not be combined together. The two types of PASSAPP commands override and replace each other. For example, a previous PASSAPP ALL command will be overridden and replaced by a subsequent PASSAPP n command (for the same destination port and source port or SID).

Hence a site-specific data file **MUST NOT** contain both a PASSAPP ALL command and a PASSAPP n command for the same destination port (TXPORT) and the same source port or SID.

For example, two commands such as:

```
SID 7 PASSAPP ALL TXPORT 3
```

and

```
SID 7 PASSAPP SYSMON,CMDCTRL TXPORT 3
```

should not both appear in a site-specific data file.

However, two commands such as:

```
SID 7 PASSAPP SYSMON,CMDCTRL TXPORT 3
```

and

```
SID 7 PASSAPP NETVARS,STATUS TXPORT 3
```

are meaningful.

When an incoming message matches the source port for one routing configuration and the SID criteria for another, then the PASSAPP command for the SID will take precedence over that for the source port.

For testing purposes, the `TXPORT a,b,c` part may be replaced with NONE to cancel any previous PASSAPP command.

The `TXPORT a,b,c` part may also be replaced with NOWHERE to install explicit routing that the specified messages should not be routed. Generally this be used in combination with the behaviour that a PASSAPP entry for a SID takes precedence over an entry for a source port.

Refer to Section 4.2.3.2 for a further discussion of concepts of Application Filtering.

5.7.4.6 Panel-link Application Numbers

At the time of publication the list of Panel-Link Application numbers is as follows.

Table 5.7.1 – Application Message Types

PASSAPP Text	App No.	Description
FF	0	FFCIF alarms. Used to transfer Change of State (COS) data from the source of the COS to devices on the network responsible for annunciating those events.
MAF	1	MAF status - provides a network message with standard panel status.
EVENT	2	Event logging (also used for zone status transmission to NLDU)
SYSMON	3	System monitor - used for transmission of I-HUB and PIB status.
NETVARS	4	Network variables for output logic - allows for the transfer of information relating to automatic control functions across the network.
STATUS	5	Status transfer (of zone/point status, to PMB for example).
CMDCTRL	6	Command/control (recalling of zone/point/system status etc. and commands such as reset/isolate/test/set time-date.)
QE90 & QE20	7	QE90 & QE20 evacuation panel intercommunications.
QE90B & QE20B	8	QE90 QE20 evacuation panel intercommunications.
TANDEM	9	Panel Tandem Mode

5.7.4.7 Product Requirements for Panel-Link Applications

The following table shows which types of Panel-Link Application broadcast messages are required by each type of device. The table does not show the types of messages the device can send, only what it needs to receive.

Table 5.7.2 - Product Broadcast Message Type Requirements

PRODUCT	Panel-Link Application broadcast message types required
MX1 Event Logging application 2 is needed only if *MX1* is logging events for other panels.	0 – Alarm Annunciation 1 – MAF Status 2 – Event Logging 3 – System Monitor 4 – Network Logic Variables 6 – Command / control 9 – Tandem LCD Link Integrity
MX4428	0 – Alarm Annunciation 1 – MAF Status 4 – Network Logic Variables 6 – Command / control 9 – Tandem LCD Link Integrity
F3200 / NDU FOR ALARMS (Application 2 event logging is needed only if the device is logging events for other panels or has a network zone alarm mimic display.)	0 – Alarm Annunciation 1 – MAF Status 2 – Event Logging 4 – Network Logic Variables 6 – Command / control 9 – Tandem LCD Link Integrity

PRODUCT	Panel-Link Application broadcast message types required
NDU Network Display Unit (for LED mimic displays, not for alarms)	1 – MAF Status 2 – Event Logging 6 – Command / control 9 – Tandem LCD Link Integrity is optional but recommended
QE90 & QE20	5 - Status Refresh 7 – QE90 Internode 8 – QE90 Internode B
PMB Panel-Link Modbus Bridge	1 – MAF status 5 – Status Refresh 6 – Command / control 9 – Tandem LCD Application 2 Event Logging messages may be needed if there are older F4000 panels on the network. Link Integrity messages are needed if the PMB is reporting Link Integrity faults to the Modbus master or it has NETFLTTX enabled.
NSA Nurse Station Annunciator (alarms display)	0 – Alarm Annunciation 1 – MAF Status 6 – Command / control 9 – Tandem LCD Link Integrity is optional but recommended
XLGraphics	0 - Alarm Annunciation 1 - MAF Status 2 - Event Logging 4 – Netvars 5 – Status Refresh Link Integrity is optional but if it's not sent to XLG then the supervision timeout for an *MX1* FIP in XLG should be increased from 90 seconds to 150 seconds. Application 5 messages are needed only if there are any MX4428 panels. Application 4 messages are needed only if XLG is displaying MX1 AS1668 fire fan control data.

5.8 QUICK CONFIGURATION SETTINGS

5.8.1 GENERAL

The I-HUB provides some quick configuration commands as follows. The version of I-HUB firmware for which the commands are available is shown in the following table. V2.00 to V2.03 firmware provide only the MX1DEFAULTS command. V2.04 or later have some extra commands.

MX1DEFAULTS	V2.00 or later firmware
MX1-MULTIDROP	V2.04 or later firmware
MX4428-RING	V2.04 or later firmware
MX4428-MULTIDROP	V2.04 or later firmware

Each of the quick config commands must be used in conjunction with the CLEARDB and SAVEDB commands as shown in the example below.

```
CLEARDB
MX1DEFAULTS
SAVEDB
```

The following sections provides some detail on what the quick config commands do. Sections 5.9 and 5.10 provide examples of how to use the quick config commands and include some example databases for common configurations. Section 5.9 applies to firmware V2.04 or later. Section 5.10 applies to firmware V2.00 to V2.03.

5.8.2 CLEARDB

The default configuration settings for the I-HUB set by the CLEARDB command are shown in Table 5.8.2.

Table 5.8.2 – Default I-HUB Configuration

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	ENABLE	DISABLE	ENABLE	DISABLE	DISABLE
MODE	MULTIDROP	MULTIDROP	MULTIDROP	MULTIDROP	PNTOPN
BAUD	9600	9600	9600	9600	9600
RXTIME	2	2	2	2	2
TXDELAY	1	1	1	1	1
ACKTIME	13	13	13	13	13
DUPTIME	40	40	40	40	40
LEADFF	1	1	1	1	1
TRAILFF	1	1	1	1	1
LINKRX	50	50	50	50	50
LINKTX	0	0	0	0	0
ROUTELIDELAY	4	4	4	4	0
RETRIES	4	4	4	4	4
EXPECTBCACK	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
ACKBCAST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
CONCATMSG	ENABLE	ENABLE	ENABLE	ENABLE	DISABLE
SENDMAFST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
QUEUE	8000,6000, 2800	8000,6000, 2800	8000,6000, 2800	8000,6000, 2800	8000,6000, 2800
LEARNSIDS	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
BCASTIHUBSTATUS	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

The above defaults provide compatibility with older versions of I-HUB software. For new installations, LEARNSIDS should usually be enabled for all ports and BCASTIHUBSTATUS should be enabled for ring ports.
The I-HUB's default global settings after CLEARDB are :

IHUB SID 243
IHUB NETMAFTX ENABLE
IHUB NETMAFTX 20 10
IHUB IHUBFLTMASTER DISABLE
IHUB SIGNALLOCALPIBFLTS DISABLE
IHUB PIBFLTMASTER DISABLE

5.8.3 MX1DEFAULTS - QUICK CONFIGURATION COMMAND

The MX1DEFAULTS command is available in V2.00 or later firmware. *MX1* connects to port 5 and ports 1 and 2 operate in ring mode at 57600 baud. The MX1DEFAULTS command must be used in conjunction with the CLEARDB command as shown below.

```
CLEARDB
MX1DEFAULTS
SAVEDB
```

The defaults set when the MX1DEFAULTS command is used are shown in Table 5.8.3. Differences from when just CLEARDB is used are indicated with grey shading.

Table 5.8.3 – MX1DEFAULTS I-HUB Configuration

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	ENABLE	DISABLE	DISABLE	DISABLE	ENABLE
MODE	RING	RING	MULTIDROP	MULTIDROP	PNTOPN
BAUD	57600	57600	9600	9600	38400
RXTIME	2	2	2	2	2
TXDELAY	1	1	1	1	1
ACKTIME	13	13	13	13	13
DUPTIME	40	40	40	40	40
LEADFF	1	1	1	1	1
TRAILFF	1	1	1	1	0
LINKRX	50	50	50	50	50
LINKTX	0	0	0	0	0
ROUTELIDELAY	4	4	4	4	4
RETRIES	4	4	4	4	4
EXPECTBCACK	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
ACKBCAST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
CONCATMSG	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
SENDMAFST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
QUEUE	12000,9000, 2800	12000,9000, 2800	12000,9000, 2800	12000,9000, 2800	12000,9000, 2800
LEARNSIDS	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
BCASTIHUBSTATUS	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

The I-HUB global settings assigned by MX1DEFAULTS are as follows.

IHUB SID NONE
IHUB NETMAFTX DISABLE
IHUB NETMAFTX 20 10
IHUB IHUBFLTMASTER DISABLE
IHUB SIGNALLOCALPIBFLTS DISABLE
IHUB PIBFLTMASTER DISABLE

The default routing is:

PORT 1,5 PASSAPP ALL TXPORT 1,5
PORT 1,5 PASSLINKI TXPORT 1,5

Note - PORT 2 is part of the ring network, and must be set to "DISABLED" when the mode for PORT 1 is set to RING.

5.8.4 MX1-MULTIDROP - QUICK CONFIGURATION COMMAND

The MX1-MULTIDROP command is available in V2.04 or later firmware. *MX1* connects to port 5 and ports one and two operate in RS485 multi-drop mode at 9600 baud. The MX1-MULTIDROP command must be used in conjunction with the CLEARDB command as shown below.

```
CLEARDB
MX1-MULTIDROP
IHUB SID 243          ; assign a unique SID number
SAVEDB
```

The configuration settings set by the MX1-MULTIDROP command are shown below in Table 5.8.4. Differences from when just CLEARDB is used are indicated with grey shading.

Table 5.8.4 – MX1-MULTIDROP Configuration

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	ENABLE	DISABLE	DISABLE	DISABLE	ENABLE
MODE	MULTIDROP	MULTIDROP	MULTIDROP	MULTIDROP	PNTOPN
BAUD	9600	9600	9600	9600	38400
RXTIME	2	2	2	2	2
TXDELAY	1	1	1	1	1
ACKTIME	13	13	13	13	13
DUPTIME	40	40	40	40	40
LEADFF	1	1	1	1	1
TRAILFF	1	1	1	1	0
LINKRX	50	50	50	50	50
LINKTX	0	0	0	0	0
ROUTELIDELAY	4	4	4	4	4
RETRIES	4	4	4	4	4
EXPECTBCACK	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
ACKBCAST	DISABLE	DISABLE	ENABLE	ENABLE	ENABLE
CONCATMSG	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
SENDMAFST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
QUEUE	12000, 9000, 2800	12000, 9000, 2800	8000,6000, 2800	8000,6000, 2800	12000, 9000, 2800
LEARNSIDS	ENABLE	ENABLE	DISABLE	DISABLE	ENABLE
BCASTIHUBSTATUS	DISABLE	DISABLE	DISABLE	DISABLE	ENABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

The I-HUB global settings assigned by MX1-MULTIDROP are as follows.

IHUB SID 243
IHUB NETMAFTX DISABLE
IHUB NETMAFTX 20 10
IHUB IHUBFLTMASTER DISABLE
IHUB SIGNALLOCALPIBFLTS DISABLE
IHUB PIBFLTMASTER DISABLE

The default routing is:

PORT 1,5 PASSAPP ALL TXPORT 1,5
PORT 1,5 PASSLINKI TXPORT 1,5

Acknowledging Broadcasts

One device (and only one) on a multi-drop network should be configured to acknowledge broadcasts using the following setting.

PORT 1,2 ACKBCAST ENABLE

Suppose that I-HUB SID 5 is configured with the above setting so that it acks all broadcasts received on port 1. One other device should be configured to ack the broadcasts sent by SID 5.

An I-HUB can be configured to ack the broadcasts sent by SID 5 with the following command.

SID 5 ACKBCAPP ALL

5.8.5 MX4428-RING - QUICK CONFIGURATION COMMAND

The MX4428-RING command is available in V2.04 or later firmware. The MX4428-RING command configures port 1,2 in ring mode at 57600 baud and port 5 in point to point mode at 9600 baud. This is suitable for use with MX4428, F3200, NDU, or NSA connected to port 5. The MX4428-RING command must be used in conjunction with the CLEARDB command as shown below.

```
CLEARDB
MX4428-RING
IHUB SID 243            ; assign a unique SID number
SAVEDB
```

Refer to Section 5.9.3 for more detail.

The defaults set when the MX4428-RING command is used are shown in Table 5.8.5. Differences from when just CLEARDB is used are indicated with grey shading.

Table 5.8.5 – MX4428-RING Configuration

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	ENABLE	DISABLE	DISABLE	DISABLE	ENABLE
MODE	RING	RING	MULTIDROP	MULTIDROP	PNTOPN
BAUD	57600	57600	9600	9600	9600
RXTIME	2	2	2	2	2
TXDELAY	1	1	1	1	1
ACKTIME	13	13	13	13	13
DUPTIME	40	40	40	40	40
LEADFF	1	1	1	1	1
TRAILFF	1	1	1	1	1
LINKRX	50	50	50	50	50
LINKTX	15	0	0	0	15
ROUTELIDELAY	4	4	4	4	0
RETRIES	4	4	4	4	4
EXPECTBCACK	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
ACKBCAST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
CONCATMSG	ENABLE	ENABLE	ENABLE	ENABLE	DISABLE
SENDMAFST	DISABLE	DISABLE	DISABLE	DISABLE	ENABLE
QUEUE	12000, 9000, 2800	12000, 9000, 2800	8000,6000, 2800	8000,6000, 2800	12000, 9000, 2800
LEARNSIDS	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
BCASTIHUBSTATUS	ENABLE	ENABLE	DISABLE	DISABLE	DISABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

The I-HUB global settings assigned by MX4428-RING are shown below.

IHUB SID 243
IHUB NETMAFTX ENABLE
IHUB NETMAFTX 20 10
IHUB IHUBFLTMASTER DISABLE
IHUB SIGNALLOCALPIBFLTS DISABLE
IHUB PIBFLTMASTER DISABLE

The default routing is as follows.

PORT 1 PASSAPP 0,1,4,6,9 TXPORT 5
PORT 5 PASSAPP ALL TXPORT 1
PORT 5 PASSLINKI TXPORT 1

Note - PORT 2 is part of the ring network, and must be set to "DISABLED" when the mode for PORT 1 is set to RING.

5.8.6 MX4428-MULTIDROP QUICK CONFIGURATION COMMAND

The MX4428-MULTIDROP command is available in V2.04 or later firmware. The MX4428-MULTIDROP command configures port 1,2 in multi-drop mode and port 5 in point to point mode at 9600 baud. This is suitable for use with MX4428, F3200, NDU, or NSA connected to port 5.

The MX4428-MULTIDROP command must be used in conjunction with the CLEARDB command as shown below. Refer to section 5.9.4 for more detail.

```
CLEARDB
MX4428-MULTIDROP
IHUB SID 243            ; assign a unique SID number
SAVEDB
```

The defaults set when the MX4428-MULTIDROP command is used are shown in Table 5.8.6. Differences from when just CLEARDB is used are indicated with grey shading.

Table 5.8.6 – MX4428-MULTIDROP Configuration

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	ENABLE	DISABLE	DISABLE	DISABLE	ENABLE
MODE	MULTIDROP	MULTIDROP	MULTIDROP	MULTIDROP	PNTOPN
BAUD	9600	9600	9600	9600	9600
RXTIME	2	2	2	2	2
TXDELAY	1	1	1	1	1
ACKTIME	13	13	13	13	13
DUPTIME	40	40	40	40	40
LEADFF	1	1	1	1	1
TRAILFF	1	1	1	1	1
LINKRX	50	50	50	50	50
LINKTX	0	0	0	0	15
ROUTELIDELAY	4	4	4	4	0
RETRIES	4	4	4	4	4
EXPECTBCACK	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
ACKBCAST	DISABLE	DISABLE	ENABLE	ENABLE	ENABLE
CONCATMSG	ENABLE	ENABLE	ENABLE	ENABLE	DISABLE
SENDMAFST	DISABLE	DISABLE	DISABLE	DISABLE	ENABLE
QUEUE	12000, 9000, 2800	12000, 9000, 2800	8000,6000, 2800	8000,6000, 2800	12000, 9000, 2800
LEARNSIDS	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
BCASTIHUBSTATUS	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

The I-HUB global settings assigned by MX4428-MULTIDROP are shown below.

IHUB SID 243
IHUB NETMAFTX ENABLE
IHUB NETMAFTX 20 10
IHUB IHUBFLTMASTER DISABLE
IHUB SIGNALLOCALPIBFLTS DISABLE
IHUB PIBFLTMASTER DISABLE

The default routing is as follows.

PORT 1 PASSAPP 0,1,4,6,9 TXPORT 5
PORT 5 PASSAPP ALL TXPORT 1
PORT 5 PASSLINKI TXPORT 1

5.8.7 A COMPLETE DATABASE TEMPLATE

The database below shows all the available settings for an I-HUB. It includes only one network port (port 1) but the options for port 1 can be copied to create any other ports that are needed.

```
CLEARDB
IHUB SID 243
IHUB NETMAFTX DISABLE
IHUB NETMAFTX 20 10
IHUB IHUBFLTMASTER DISABLE
IHUB SIGNALLOCALPIBFLTS DISABLE
IHUB PIBFLTMASTER DISABLE
;
PORT 1 ENABLE
PORT 1 MODE RING
PORT 1 BAUD 57600
PORT 1 RXTIME 2
PORT 1 TXDELAY 1
PORT 1 ACKTIME 13
PORT 1 DUPTIME 40
PORT 1 LEADFF 1
PORT 1 TRAILFF 1
PORT 1 LINKRX 50
PORT 1 LINKTX 15
PORT 1 ROUTELIDELAY 4
PORT 1 RETRIES 4
PORT 1 EXPECTBCACK ENABLE
PORT 1 ACKBCAST ENABLE
PORT 1 CONCATMSG ENABLE
PORT 1 SENDMAFST DISABLE
PORT 1 LEARNSIDS ENABLE
PORT 1 BCASTIHUBSTATUS ENABLE
PORT 1 HIDEMSGDISCARD DISABLE
PORT 1 QUEUE 12000, 9000, 2800
;
; PORT 1,5 PASSAPP ALL TXPORT 1,5
; PORT 1,5 PASSLINKI TXPORT 1,5
```

5.9 DATABASE EXAMPLES WITH V2.04 OR LATER FIRMWARE

The configurations documented in this section utilise the quick configuration commands MX1DEFAULTS, MX1-MULTIDROP, MX4428-RING, and MX4428-MULTIDROP. These are provided by V2.04 or later firmware. If the I-HUB has V2.00, V2.01, V2.02 or V2.03 firmware, refer to section 5.10. If the I-HUB has V1.XX firmware then refer to the manual that came with that firmware (or upgrade the firmware).

5.9.1 *MX1* ON A RING (FACTORY DEFAULT)

An I-HUB is supplied with the *MX1* DEFAULTS configuration shown below. This allows the I-HUB to be connected to a ring network with an *MX1* on Port 5 with no additional field programming of the I-HUB required. The MX1DEFAULTS command configures ports 1 & 2 for ring mode at 57600 baud with port 5 configured at 38400 baud to match the default baud rate of the *MX1* network port. The *MX1* network port should be connected to the I-HUB TTL port 5 using LM0152.

FACTORY DEFAULT DATABASE WITH V2.00 OR LATER FIRMWARE

`CLEARDB`
`MX1DEFAULTS`
`SAVEDB`

For this configuration, the I-HUB does not need to have its own SID number. The SID of the *MX1* is 'borrowed' by the I-HUB. All routing of Panel-Link messages and the determination of what SIDs are on what ports is carried out automatically by the I-HUB. All messages sent by the *MX1* are sent on to the ring, and all messages received from the ring are passed to the *MX1*.

MX1 monitors the fault status of the I-HUB and reports this using *MX1* Controller points 241.32.x.

5.9.2 MX1-MULTIDROP - *MX1* ON A MULTI-DROP NETWORK

The MX1-MULTIDROP command is available in V2.04 or later I-HUB firmware.

The MX1-MULTIDROP quick configuration command allows the I-HUB and *MX1* to be connected onto an existing MX4428 or F3200 multidrop (dual bus) network.

The MX1-MULTIDROP command assigns the *MX1* onto port 5 and ports 1,2 in multi-drop mode. The I-HUB must be assigned its own unique SID number.

```
CLEARDB
MX1-MULTIDROP
IHUB SID 200       ; Assign a unique SID number
SAVEDB
```

The I-HUB does NOT need to be programmed into the SID Points table in *MX1*.

Acknowledge broadcast settings

Generally this command will be used when adding an *MX1* to an existing MX4428 or F3200 network, so it includes an ACKBCAST disable command for ports 1,2, as there will most likely be a device on the network already configured to ack broadcasts.

```
PORT 1,2 ACKBCAST DISABLE
```

If however, the I-HUB is to be the single device acknowledging broadcast messages then it will need to have an ACKBCAST ENABLE command as follows:

```
CLEARDB
MX1-MULTIDROP
PORT 1,2 ACKBCAST ENABLE     ; one IHUB only
IHUB SID 200                 ; Assign a unique SID number
SAVEDB
```

One other device on the multi-drop network should be configured to ack the broadcasts sent by this I-HUB (SID 200). For example, for another I-HUB:

```
CLEARDB
MX1-MULTIDROP
SET PLINK SID 200 ACKBCAPP ALL     ; one IHUB only
IHUB SID 201                       ; Assign a unique SID number
SAVEDB
```

5.9.3 MX4428-RING - RING MODE WITH MX4428, F3200, NDU OR NSA ON PORT 5

The MX4428-RING command is available with V2.04 or later I-HUB firmware.

The "MX4428-RING" quick configuration command can be used with an MX4428, F3200, NDU, NSA or COMPACT FF on port 5 of the I-HUB connected to a ring network. I.e. it is not restricted to just MX4428 panels. This configures ports 1,2 in ring mode at 57600 baud and port 5 at 9600 baud in point to point mode. The I-HUB must be assigned its own unique SID number.

```
CLEARDB
MX4428-RING
IHUB SID 200          ; Assign a unique SID number
SAVEDB
```

5.9.3.1 EVENT LOGGING APPLICATION MESSAGES FOR F3200/ NDU

If the device on port 5 is an F3200 or NDU that is doing network event logging or has a network zone LED mimic display, then application 2 messages must be sent to port 5 so the following command must be included.

```
PORT 1 PASSAPP 2 TXPORT 5
```

5.9.3.2 FAULT REPORTING

1. **If an *MX1* panel is present somewhere on the I-HUB ring**, it can be used to monitor the faults of any I-HUBs on the ring that are not connected to an *MX1*. Reporting I-HUB faults on an *MX1* is preferable to reporting the faults on an MX4428 (or other panel type) using I-HUB MAF status because an *MX1* can show more detailed information about the fault.

To configure an *MX1* to report faults for a remote I-HUB, the I-HUB should be configured in the *MX1* SID points table with a type of "Monitored I-HUB" and a SID Config Profile of "I-HUB with SID". *MX1* will expect to receive Link Integrity messages from the I-HUB. The MX4428-RING command configures the I-HUB to send link integrity on ports 1 and 2 (`PORT 1 LINKTX 15`).

Otherwise

2. **If there are no MX1 panels anywhere on the I-HUB ring** then one I-HUB on the ring should be configured as an I-HUB fault master as follows.

```
CLEARDB
MX4428-RING
IHUB SID 200
IHUB IHUBFLTMASTER ENABLE
PORT 1 SENDMAFST ENABLE       ; send MAF status to port 1 and 5
SAVEDB
```

The fire panel that is connected to port 5 of the I-HUB fault master should have the I-HUB in its SID list and be configured to monitor the MAF status of the I-HUB. The I-HUB fault master will report a fault in its MAF status whenever any of the I-HUBs on the ring have a fault. The panel connected to the I-HUB fault master does not indicate which specific I-HUB has a fault, so the I-HUB diagnostics terminal can be used to determine where the fault is.

5.9.3.3 MX4428-RING AND LINK INTEGRITY

The default routing created by the MX4428-RING command is as follows.

```
PORT 1 PASSAPP 0,1,4,6,9 TXPORT 5
PORT 5 PASSAPP ALL TXPORT 1
PORT 5 PASSLINKI TXPORT 1
```

Generally link integrity messages should be passed to port 5 so a `PASSLINKI` command must be added to map the required SID, or all, link integrity messages to Port 5.
E.g.

```
SID 3-10, 12, 15 PASSLINKI TXPORT 5
```

OR

```
PORT 1 PASSLINKI TXPORT 5
```

5.9.4 MX4428-MULTIDROP - MULTI-DROP MODE WITH MX4428, F3200, NDU OR NSA ON PORT 5

The MX4428-MULTIDROP command is available with V2.04 or later I-HUB firmware.

The "MX4428-MULTIDROP" quick configuration command can be used in an I-HUB on a multidrop network with any of MX4428, F3200, NDU, NSA or COMPACT FF connected on port 5. I.e. it is not restricted to just MX4428 panels. This configures ports 1,2 in multi-drop mode at 9600 baud and port 5 at 9600 baud in point to point mode. The I-HUB must be assigned its own unique SID number.

```
CLEARDB
MX4428-MULTIDROP
IHUB SID 200           ; Assign a unique SID number
SAVEDB
```

Acknowledge broadcast settings

Generally this command will be used when adding a panel to an existing multidrop network so acknowledgement of broadcasts needs to be disabled. The MX4428 MULTIDROP configuration includes an ACKBCAST DISABLE command for ports 1,2.

If however, the I-HUB is to be the single device acknowledging broadcast messages then it will need to have an ACKBCAST ENABLE command as follows:

```
CLEARDB
MX4428-MULTIDROP
PORT 1,2 ACKBCAST ENABLE     ; one IHUB only
IHUB SID 200                 ; Assign a unique SID number
SAVEDB
```

One other device on the multi-drop network should be configured to ack the broadcasts sent by this I-HUB (SID 200). E.g., for another I-HUB:

```
CLEARDB
MX4428-MULTIDROP
SET PLINK SID 200 ACKBCAPP ALL     ; one IHUB only
IHUB SID 201                       ; Assign a unique SID number
SAVEDB
```

Link Integrity

The default routing created by the MX4428-MULTIDROP command is as follows.

```
PORT 1 PASSAPP 0,1,4,6,9 TXPORT 5
PORT 5 PASSAPP ALL TXPORT 1
PORT 5 PASSLINKI TXPORT 1
```

Generally link integrity messages should be passed to port 5 so a `PASSLINKI` command must be added to map the required SID, or all, link integrity messages to Port 5.
E.g.,

```
SID 3-10, 12, 15 PASSLINKI TXPORT 5
```

OR

```
PORT 1 PASSLINKI TXPORT 5
```

Passing Application 2 messages (Event Logging) to Port 5

If the device on port 5 is an F3200 or NDU that is doing network event logging or has a network zone LED mimic display then application 2 messages must be sent to Port 5 so the following command must be included.

```
PORT 1 PASSAPP 2 TXPORT 5
```

5.9.5 RING MODE WITH PIB ON PORT 5

The configuration below can be used with V2.00 or later I-HUB firmware.

When the device on port 5 is a PIB, the MX1DEFAULTS command can be used to enable ring mode on ports 1 and 2. The baud rate on port 5 must be set to match the connected device and the I-HUB must have its own SID number. The PIB default baud rate is 9600 so it should be changed to 38400.

RING MODE WITH PIB ON PORT 5

```
CLEARDB
MX1DEFAULTS
IHUB SID 200                      ; assign a unique SID number
PORT 1 LINKTX 15                  ; send IHUB link integrity on port 1
PORT 5 BAUD 38400                 ; set the baud rate as needed
PORT 5 QUEUE 20000, 15000, 5000   ; larger queues for port 5
;; IHUB NETMAFTX ENABLE
SAVEDB
```

Loom LM0434 is used for connecting the PIB to the I-HUB TTL port 5. LM0559 is used for connecting to the I-HUB RS232 ports 3 or 4. Wiring is covered in the PIB User Manual, LT0519.

Messages from the I-HUB ring will be transmitted by the PIB to remote PIBs. Messages received from remote PIBs will be transmitted onto the I-HUB ring by the I-HUB. The flow of messages can be restricted by filtering at the I-HUB or PIB.

When the I-HUB is also directly connected to an *MX1*, the I-HUB will send fault status from the PIB to *MX1* controller points 241.32.1 (local) and 241.32.2 (remote).

The PIB may also be monitored by a remote PIB fault master.

Note: the MX1DEFAULTS command configures the I-HUB to not send MAF status on the network. To monitor faults of the I-HUB itself, it may be necessary to enable the sending of MAF status by un-commenting the `IHUB NETMAFTX ENABLE` command in the example above.

5.9.6 RING MODE WITH I-HUB ON PORT 5

The configuration below can be used with V2.00 or later I-HUB firmware.

When the device on port 5 is another I-HUB, the MX1DEFAULTS command can be used to enable ring mode on ports 1 and 2. The I-HUB must have its own SID number.

RING MODE WITH I-HUB ON PORT 5

```
CLEARDB
MX1DEFAULTS
IHUB SID 200                      ; assign a unique SID number
PORT 1 LINKTX 15                  ; send IHUB link integrity on port 1
PORT 5 BAUD 38400
PORT 5 QUEUE 20000, 15000, 5000   ; larger queues for port 5
;; IHUB NETMAFTX ENABLE
SAVEDB
```

Loom LM0152 can be used to connect TTL port 5 on one I-HUB to port 5 on another I-HUB.

5.9.7 RING MODE WITH *MX1* ON PORT 5, PMB ON PORT 3

The configuration below can be used with V2.00 or later I-HUB firmware. The PMB connects to port 3 of the I-HUB in point to point mode at 19200 baud.

The I-HUB must have its own unique SID number if port 3 is enabled so the SID number of 243 shown in the example below must be changed to an appropriate value. A PASSAPP command is used so that only essential data is passed to the PMB on port 3. If NETFLTTX is enabled in the PMB then Link Integrity must also be passed to the PMB.

The I-HUB SID number (243 in this example) does NOT need to be in the SID list of the *MX1*. *MX1* will monitor and report the status of the I-HUB without the I-HUB being in its SID list.

Kit KT0144 (includes PA0712 RS232 to RS485 conversion board) can be used to connect the I-HUB RS232 port 3 to a PMB.

RING MODE WITH *MX1* ON PORT 5, PMB ON PORT 3

```
CLEARDB
MX1DEFAULTS
IHUB SID 243                ; assign a unique SID number
PORT 3 ENABLE
PORT 3 MODE PNTOPN
PORT 3 BAUD 19200
PORT 3 BCASTIHUBSTATUS DISABLE
PORT 3 QUEUE 20000, 15000, 5000       ; larger buffer for PMB
PORT 1,5 PASSAPP 1,5,6,9 TXPORT 3
PORT 3 PASSAPP ALL TXPORT 1,5
PORT 3 PASSLINKI TXPORT 1,5
SAVEDB
```

5.9.8 RING MODE WITH MX4428/ F3200/ NSA ON PORT 3, *MX1* ON PORT 5

The configuration below can be used with V2.00 or later I-HUB firmware. The MX4428/ F3200/ NDU/ NSA connects to port 3 of the I-HUB in point to point mode at 9600 baud and the *MX1* is on Port 5.

RING MODE WITH *MX1* ON PORT 5, MX4428/ F3200 ON PORT 3

```
CLEARDB
MX1DEFAULTS
IHUB SID 243                ; assign a unique SID number
PORT 3 ENABLE
PORT 3 MODE PNTOPN
PORT 3 BAUD 9600
PORT 3 BCASTIHUBSTATUS DISABLE
PORT 1,5 PASSAPP 0,1,5,6,9 TXPORT 3
PORT 3 PASSAPP ALL TXPORT 1,5
PORT 3 PASSLINKI TXPORT 1,5
SAVEDB
```

The I-HUB must have its own unique SID number if port 3 is enabled so the SID number of 243 shown in the example below must be changed to an appropriate value. A PASSAPP command is used so that only essential data is passed to the device on port 3.

The I-HUB SID number (243 in this example) does NOT need to be in the SID list of the *MX1*. *MX1* will monitor and report the status of the I-HUB without the I-HUB being in its SID list.

If the device on port 3 is an F3200 or NDU that is doing network event logging or has a network zone LED mimic display then application 2 messages must be sent on port 3 so the following command must be included.

```
PORT 1,2 PASSAPP 0,1,2,5,6,9 TXPORT 3.
```

If network variables from particular panels need to be sent to port 3 then a command similar to the following can be used.

```
SID 1,3,17 PASSAPP 4 TXPORT 3
```

Similarly, selective link integrity can be passed to port 3 e.g.

```
SID 1,3,17 PASSLINKI TXPORT 3
```

5.9.9 RING MODE WITH XLGRAPHICS ON PORT 3

The configuration below can be used with V2.00 or later I-HUB firmware.

This example assumes that the SID number of the I-HUB is 243 and the SID number of XLG is 99. Link Integrity messages should not be sent to XLG. XLGraphics software version 7.14K or later allows the baud rate of the network port to be configured. The configuration below sets a baud rate for port 3 of 38400 and this must also be configured in XLGraphics in the I-HUB interface. Older versions of XLGraphics use a fixed baud rate of 9600. For a large system, it may be necessary to restrict the types of messages that are sent to XLG.

The SID number assigned to XLG is configured in the XLG database using the "XLG Command SID" sub-property of the "PanelLink" property group in the interface icon (I-HUB, PIB).

RING MODE WITH XLGRAPHICS ON PORT 3

```
CLEARDB
IHUB SID 243          ; assign a unique SID number to the IHUB
SID 99 PORT 3            ; set according to the XLG SID number
IHUB NETMAFTX DISABLE
PORT 1 ENABLE
PORT 1-2 MODE RING
PORT 1-2 BAUD 57600
PORT 1 BCASTIHUBSTATUS ENABLE
PORT 1 LINKTX 15
PORT 3 ENABLE
PORT 3 MODE PNTOPN
PORT 3 BAUD 38400
PORT 3 RETRIES 8           ; increase number of retries to 8
PORT 3 EXPECTBCACK ENABLE
PORT 3 HIDEMSGDISCARD ENABLE
PORT 1-5 LEARNSIDS ENABLE
PORT 1-2 QUEUE 12000,9000,2800
PORT 3 QUEUE 30000,26000,5000       ; larger buffer for XLG
PORT 3 PASSLINKI TXPORT 1
PORT 3 PASSAPP ALL TXPORT 1
PORT 1 PASSAPP 0,1,2,4,5,6 TXPORT 3     ; see NOTE 1 below
SAVEDB
```

NOTE 1:
If the types of panels whose messages are being passed to XLG through this I-HUB are all *MX1* panels then application 5 (Status Refresh) messages do not need to be passed to XLG. i.e. `PASSAPP 0,1,2,4,6`

If the types of panels whose messages are being passed to XLG through this I-HUB are all MX4428 panels then application 4 messages (Netvars) do not need to be passed to XLG. i.e. `PASSAPP 0,1,2,5,6`.

If the types of panels whose messages are being passed to XLG through this I-HUB are all F3200/ NDU panels then application 4 and 5 messages do not need to be passed to XLG i.e. `PASSAPP 0,1,2,6`.

5.9.10 RING MODE WITH PMB ON PORT 5

The configuration below can be used with V2.00 or later I-HUB firmware.

The I-HUB must have its own SID number so the SID number of 243 shown in the example below must be changed to an appropriate value. A PASSAPP command is used so that only essential data is passed to the PMB on port 5. If NETFLTTX is enabled in the PMB then Link Integrity must also be passed to the PMB.

A PA0773 RS485 board is needed to convert I-HUB port 5 TTL to RS485. Refer to the PMB User Manual (LT0202) for details of the RS485 wiring needed.

RING MODE WITH PMB ON PORT 5

```
CLEARDB
IHUB SID 243                   ; assign a unique SID number
IHUB NETMAFTX DISABLE
PORT 1 ENABLE
PORT 1-2 MODE RING
PORT 1-2 BAUD 57600
PORT 1 BCASTIHUBSTATUS ENABLE
PORT 1-5 LEARNSIDS ENABLE
PORT 1,2 QUEUE 12000,9000,2800
PORT 3 DISABLE
PORT 5 ENABLE
PORT 5 MODE PNTOPN
PORT 5 BAUD 19200
PORT 5 BCASTIHUBSTATUS DISABLE
PORT 5 QUEUE 20000, 15000, 5000      ; larger queue for PMB
PORT 1 PASSAPP 1,5,6,9 TXPORT 5
PORT 5 PASSAPP ALL TXPORT 1
PORT 5 PASSLINKI TXPORT 1
;;SID x,y,z PASSLINKI TXPORT 5
SAVEDB
```

5.10 DATABASE EXAMPLES WITH I-HUB FIRMWARE V2.00 TO V2.03

This section applies to I-HUBs with firmware V2.00 to V2.03 firmware which provide the MX1DEFAULTS command but do not provide MX1-MULTIDROP, MX4428-RING, and MX4428-MULTIDROP commands. If the I-HUB has V2.04 or later firmware, refer to section 5.9. The quick configuration commands are not provided with V1.XX firmware.

The configurations given below are also valid with V2.04 or later firmware.

5.10.1 RING NETWORK OF *MX1* FIRE PANELS

For a network of only *MX1* fire panels connected by a ring of I-HUBs using RS485 with twisted pair cabling, the configuration of each I-HUB in the ring is as follows.

FACTORY DEFAULT DATABASE WITH V2.XX FIRMWARE

```
CLEARDB
MX1DEFAULTS
SAVEDB
```

Refer to section 5.9.1 for more detail.

5.10.2 PORT 1 RING WITH MX4428/ F3200/ NDU/ NSA/ COMPACT FF ON PORT 5

The following applies to I-HUBs with V2.00 to V2.03 firmware. With V2.04 or later firmware, refer to section 5.9.3.

Because there is no *MX1* on port 5, the I-HUB must have its own SID number so the SID number of 243 shown in the template below must be changed to an appropriate value. A PASSAPP command is used so that only essential data is passed to the device on port 5. If any Link Integrity needs to be sent to the device on port 5, the PASSLINKI command should be un-commented and adjusted.

PORT 1 RING WITH MX4428/ F3200/ NDU/ NSA/ COMPACT FF ON PORT 5

```
CLEARDB
IHUB SID 243              ; assign a unique SID number
IHUB NETMAFTX DISABLE
PORT 1 ENABLE             ; port 2 must be left as disabled
PORT 1-2 MODE RING
PORT 1-2 BAUD 57600
PORT 1 BCASTIHUBSTATUS ENABLE
PORT 1-5 LEARNSIDS ENABLE
PORT 1,2 QUEUE 12000,9000,2800
PORT 1 LINKTX 15     ; linktx is needed if a remote MX1 is monitoring this IHUB
PORT 3 DISABLE
PORT 5 ENABLE                   ; point to point, 9600 baud is default
PORT 5 QUEUE 20000, 15000, 5000
PORT 1 PASSAPP 0,1,4,6,9 TXPORT 5    ; send alarms, maf status, netvars
PORT 5 PASSAPP ALL TXPORT 1
PORT 5 PASSLINKI TXPORT 1
;;SID x,y,z PASSLINKI TXPORT 5       ; uncomment if needed
SAVEDB
```

If the device on port 5 is an F3200/ NDU doing network event logging or is an NDU with a network zone LED mimic display, then it must be sent Panel-Link Application 2 Event Logging messages as follows.

```
PORT 1 PASSAPP 0,1,2,4,6,9 TXPORT 5
```

Application 2 messages should not be sent to an MX4428.

Monitoring I-HUB faults

Refer to section 5.12 for details of how I-HUB fault monitoring works.

If there is an *MX1* panel somewhere on the ring then it should be used to report faults for all I-HUBs that don't have an *MX1* connected. The MX1 should have the remote I-HUB configured in its SID points table with a type of "Monitored I-HUB" and use the default SID config profile of "I-HUB with SID".

If there are no *MX1* panels anywhere on the I-HUB ring then one I-HUB on the ring should be configured as an I-HUB fault master as follows.

```
IHUB IHUBFLTMASTER ENABLE
IHUB NETMAFTX ENABLE
PORT 1-3 SENDMAFST DISABLE     ; send MAF status to port 5 only
```

The fire panel that is connected to port 5 of the I-HUB fault master should have the I-HUB in its SID list and be configured to monitor the MAF status of the I-HUB to pick up faults off the ring.

5.10.3 PORT 1 MULTI-DROP WITH *MX1* ON PORT 5

The following applies to I-HUBs with V2.00 to V2.03 firmware. With V2.04 or later firmware, refer to section 5.9.2. The I-HUB must have its own SID number when multi-drop mode is used.

PORT 1 MULTI-DROP WITH *MX1* ON PORT 5

```
CLEARDB
IHUB SID 200              ; assign a unique SID number
IHUB NETMAFTX DISABLE
PORT 1,2 MODE MULTIDROP
PORT 1,2 BAUD 9600
PORT 1,2 ACKBCAST DISABLE
PORT 3 DISABLE
PORT 5 ENABLE
PORT 5 MODE PNTOPN
PORT 5 BAUD 38400
PORT 5 BCASTIHUBSTATUS ENABLE
PORT 1,2,5 QUEUE 12000, 9000, 2800
PORT 1,2,5 LEARNSIDS ENABLE
PORT 1,5 PASSAPP ALL TXPORT 1,5
PORT 1,5 PASSLINKI TXPORT 1,5
SAVEDB
```

Acknowledge broadcast settings

Generally this command will be used when adding an *MX1* to an existing MX4428 or F3200 network, so it includes an ACKBCAST DISABLE command, as there will most likely be a device on the network already configured to ACK broadcasts.

If however, the I-HUB is to be the single device acknowledging broadcast messages then it will need to have an ACKBCAST ENABLE command as follows:

```
PORT 1,2 ACKBCAST ENABLE     ; one IHUB only
```

One other device on the multi-drop network should be configured to ack the broadcasts sent by this I-HUB (SID 200). E.g., for another I-HUB.

```
SET PLINK SID 200 ACKBCAPP ALL     ; one IHUB only
```

5.10.4 PORT 1 MULTI-DROP WITH MX4428/F3200/NDU/NSA/COMPACT FF ON PORT 5

The following applies to I-HUBs with V2.00 to V2.03 firmware. With V2.04 or later firmware, refer to section 5.9.4. The I-HUB must have its own SID number when multi-drop mode is used.

PORT 1 MULTI-DROP WITH MX4428/ F3200/ NDU/ NSA/ COMPACT FF ON PORT 5

```
CLEARDB
IHUB SID 200               ; assign a unique SID number
IHUB NETMAFTX ENABLE
PORT 1-4 SENDMAFST DISABLE
PORT 1-5 LEARNSIDS ENABLE
PORT 1,2,5 QUEUE 12000, 9000, 2800
PORT 1,2 MODE MULTIDROP
PORT 1,2 BAUD 9600
PORT 1,2 ACKBCAST DISABLE
PORT 3 DISABLE
PORT 5 ENABLE
PORT 5 MODE PNTOPN
PORT 5 BAUD 9600
PORT 5 LINKTX 15         ; add the IHUB SID to the MX4428 SID list
PORT 5 SENDMAFST ENABLE
PORT 5 PASSAPP ALL TXPORT 1
PORT 5 PASSLINKI TXPORT 1
PORT 1 PASSAPP 0,1,4,6,9 TXPORT 5
;; SID 3-10, 17, 35 PASSLINKI TXPORT 5
SAVEDB
```

Acknowledge broadcast settings

Generally this example will be used when adding an MX4428/F3200/NDU/NSA/Compact FF to an existing MX4428 or F3200 network, so it includes an ACKBCAST DISABLE command, as there will most likely be a device on the network already configured to ACK broadcasts.
If however, the I-HUB is to be the single device acknowledging broadcast messages then it will need to have an ACKBCAST ENABLE command as follows:

```
PORT 1,2 ACKBCAST ENABLE     ; one IHUB only
```

One other device on the multi-drop network should be configured to ack the broadcasts sent by this I-HUB (SID 200). E.g., for another I-HUB.

```
SET PLINK SID 200 ACKBCAPP ALL     ; one IHUB only
```


Event Logging Application messages

If the device on port 5 is an F3200 or NDU that is doing network event logging or has a network zone LED mimic display, then application 2 messages must be sent to port 5 so the following command must be included.

```
PORT 1 PASSAPP 2 TXPORT 5
```

5.10.5 PORT 1 MULTIDROP, XLGRAPHICS ON PORT 3

The following applies to I-HUBs with V2.xx firmware. The I-HUB must have its own SID number when multi-drop mode is used.

XLGraphics software version 7.14K or later, allows the baud rate of the network port to be configured. The configuration below sets a baud rate for port 3 of 38400 and this must also be configured in XLGraphics in the I-HUB interface. Older versions of XLGraphics use a fixed baud rate of 9600.

PORT 1 MULTI-DROP WITH XLG ON PORT 3

```
CLEARDB
IHUB SID 200             ; assign a unique SID number to the I-HUB
IHUB NETMAFTX DISABLE
PORT 1,2 MODE MULTIDROP
PORT 1,2 BAUD 9600
PORT 1,2 ACKBCAST DISABLE
PORT 1,2 QUEUE 12000, 9000, 2800
PORT 1-5 LEARNSIDS ENABLE
PORT 5 DISABLE
PORT 3 ENABLE
PORT 3 MODE PNTOPN
PORT 3 BAUD 38400
PORT 3 HIDEMSGDISCARD ENABLE
PORT 3 EXPECTBCACK ENABLE
PORT 3 RETRIES 8
PORT 3 QUEUE 30000,26000,5000       ; larger buffer for XLG
PORT 1 PASSAPP 0,1,2,4,5 TXPORT 3
PORT 3 PASSAPP ALL TXPORT 1
PORT 3 PASSLINKI TXPORT 1
SAVEDB
```

Acknowledge broadcast settings

Generally this example will be used when adding an XLG to an existing MX4428 or F3200 network, so it includes an ACKBCAST DISABLE command, as there will most likely be a device on the network already configured to ACK broadcasts.
If however, the I-HUB is to be the single device acknowledging broadcast messages then it will need to have an ACKBCAST ENABLE command as follows:

```
PORT 1,2 ACKBCAST ENABLE     ; one IHUB only
```

One other device on the multi-drop network should be configured to ack the broadcasts sent by this I-HUB (SID 200), e.g., for another I-HUB.

```
SET PLINK SID 200 ACKBCAPP ALL     ; one IHUB only
```

5.10.6 OTHER CONFIGURATIONS

With I-HUB firmware V2.00 to V2.03, Section 5.9 can be referred to for the following configurations. For all of the configurations below, the I-HUB must have its own SID number.

Ring mode with PIB on port 5	Section 5.9.5
Ring mode with I-HUB on port 5	Section 5.9.6
Ring mode with MX1 on port 5, PMB on port 3	Section 5.9.7
Ring mode with XLGraphics on port 3	Section 5.9.9
Ring mode with PMB on port 5	Section 5.9.10

The only configuration for which the I-HUB does not need its own SID number is when PORT 1,2 are in ring mode, port 3 and 4 are disabled and an *MX1* is connected to port 5.

5.11 PORT SETTINGS FOR SPECIFIC TOPOLOGIES

This section describes the "network" and port settings for some typical topologies.

5.11.1 EXAMPLE 1: RING NETWORK

An example ring network is shown in Figure 5.11.1. The ring is being run at 57600 baud. Each "Panel-Link" port (I-HUB TTL port 5 in this example) will be run at 9600 baud.

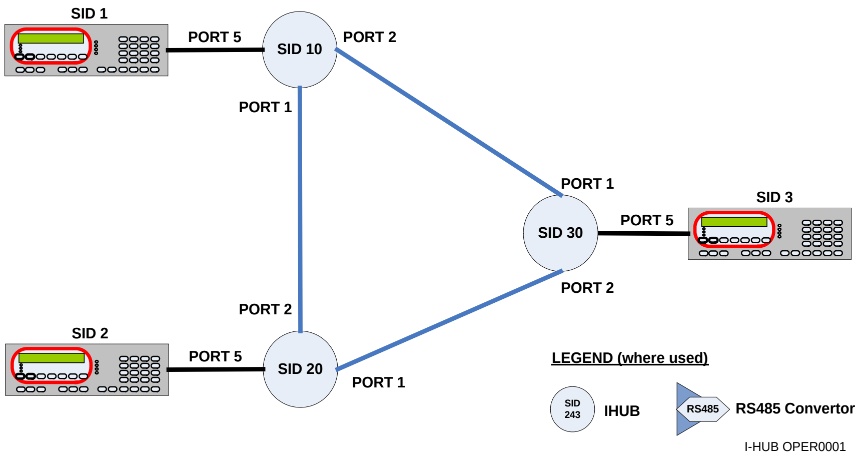


Figure 5.11.1 – Example 1: Ring Network

The setup for each I-HUB's physical ports 1 to 5 is shown in Table 5.11.1.

Table 5.11.1 – Example 1 Ring Port Setup

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	ENABLE	DISABLE	DISABLE	DISABLE	ENABLE
MODE	RING	RING	MULTIDROP	MULTIDROP	PNTOPN
BAUD	57600	57600	9600	9600	9600
RXTIME	2	2	2	2	2
TXDELAY	1	1	1	1	1
ACKTIME	13	13	13	13	13
DUPTIME	40	40	40	40	40
LEADFF	1	1	1	1	1
TRAILFF	1	1	1	1	1
LINKRX	50	50	50	50	50
LINKTX	0	0	0	0	0
ROUTELIDELAY	4	4	4	4	0
RETRIES	4	4	4	4	4
EXPECTBCACK	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
ACKBCAST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
CONCATMSG	ENABLE	ENABLE	ENABLE	ENABLE	DISABLE
SENDMAFST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
QUEUE	8000,6000,2800	8000,6000,2800	8000,6000,2800	8000,6000,2800	8000,6000,2800
LEARNSIDS	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
BCASTIHUBSTATUS	ENABLE	ENABLE	DISABLE	DISABLE	DISABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

Note that PORT 2 is part of the ring network, and must be set to "DISABLED" when the mode for PORT 1 is set to RING. The mode setting for PORT 2 is ignored.

5.11.2 EXAMPLE 2: RS485 POINT-TO-POINT

A small point-to-point network is shown in Figure 5.11.2.

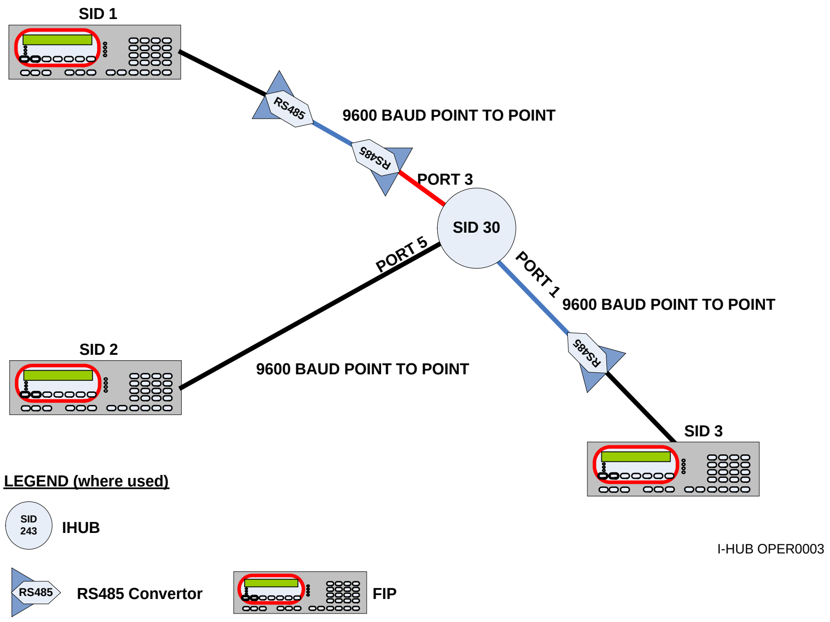


Figure 5.11.2 – Example 2: Point-to-Point Network

The configuration for Figure 5.11.2 is shown in Table 5.11.2.

Table 5.11.2 – Example 2 Point-to-Point Port Setup

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	ENABLE	DISABLE	ENABLE	DISABLE	ENABLE
MODE	PNTOPN	PNTOPN	PNTOPN	MULTIDROP	PNTOPN
BAUD	9600	9600	9600	9600	9600
RXTIME	2	2	2	2	2
TXDELAY	1	1	1	1	1
ACKTIME	13	13	13	13	13
DUPTIME	40	40	40	40	40
LEADFF	1	1	1	1	1
TRAILFF	1	1	1	1	1
LINKRX	50	50	50	50	50
LINKTX	0	0	0	0	0
ROUTELIDELAY	0	4	0	4	0
RETRIES	4	4	4	4	4
EXPECTBCACK	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
ACKBCAST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
CONCATMSG	DISABLE	DISABLE	DISABLE	ENABLE	DISABLE
SENDMAFST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
QUEUE	8000,6000,2800	8000,6000,2800	8000,6000,2800	8000,6000,2800	8000,6000,2800
LEARNSIDS	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
BCASTIHUBSTATUS	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

BCASTIHUBSTATUS should be enabled if there is an *MX1* panel connected to the port.

5.11.3 EXAMPLE 3: RS485 MULTI-DROP

A small multi-drop network is shown in Figure 5.11.3.

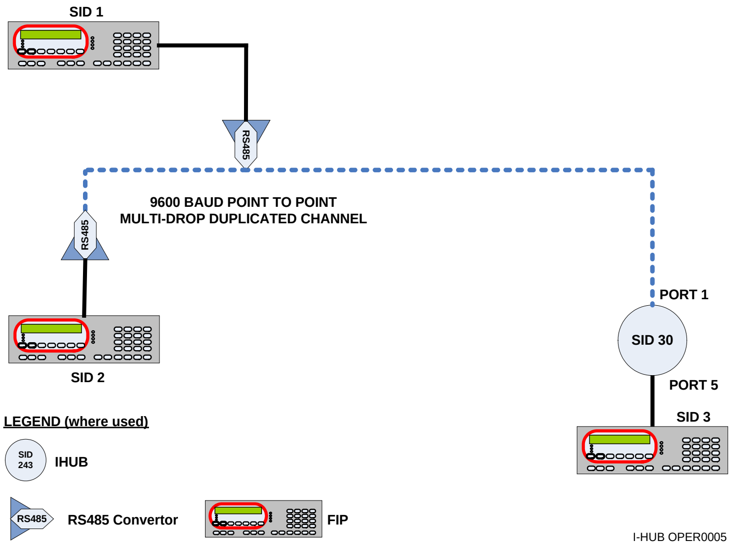


Figure 5.11.3 – Example 3: Multi-drop Network

The configuration for Figure 5.11.3 is shown in Table 5.11.3.

Table 5.11.3 – Example 3 Multi-Drop Port Setup

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	ENABLE	DISABLE	DISABLE	DISABLE	ENABLE
MODE	MULTIDROP	MULTIDROP	PNTOPN	PNTOPN	PNTOPN
BAUD	9600	9600	9600	9600	9600
RXTIME	2	2	2	2	2
TXDELAY	1	1	1	1	1
ACKTIME	13	13	13	13	13
DUPTIME	40	40	40	40	40
LEADFF	1	1	1	1	1
TRAILFF	1	1	1	1	1
LINKRX	50	50	50	50	50
LINKTX	0	0	0	0	0
ROUTELIDELAY	4	4	0	0	0
RETRIES	4	4	4	4	4
EXPECTBCACK	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
ACKBCAST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
CONCATMSG	ENABLE	DISABLE	DISABLE	DISABLE	DISABLE
SENDMAFST	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
QUEUE	8000,6000,2800	8000,6000,2800	8000,6000,2800	8000,6000,2800	8000,6000,2800
LEARNSIDS	ENABLE	ENABLE	ENABLE	ENABLE	ENABLE
BCASTIHUBSTATUS	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

BCASTIHUBSTATUS may need to be enabled for a port if there are *MX1* panels on the port that need to receive it so they can monitor I-HUB faults.

5.11.4 EXAMPLE 4: V-MODEM

A remote FIP can be connected by V-Modem as shown in Figure 5.11.4.

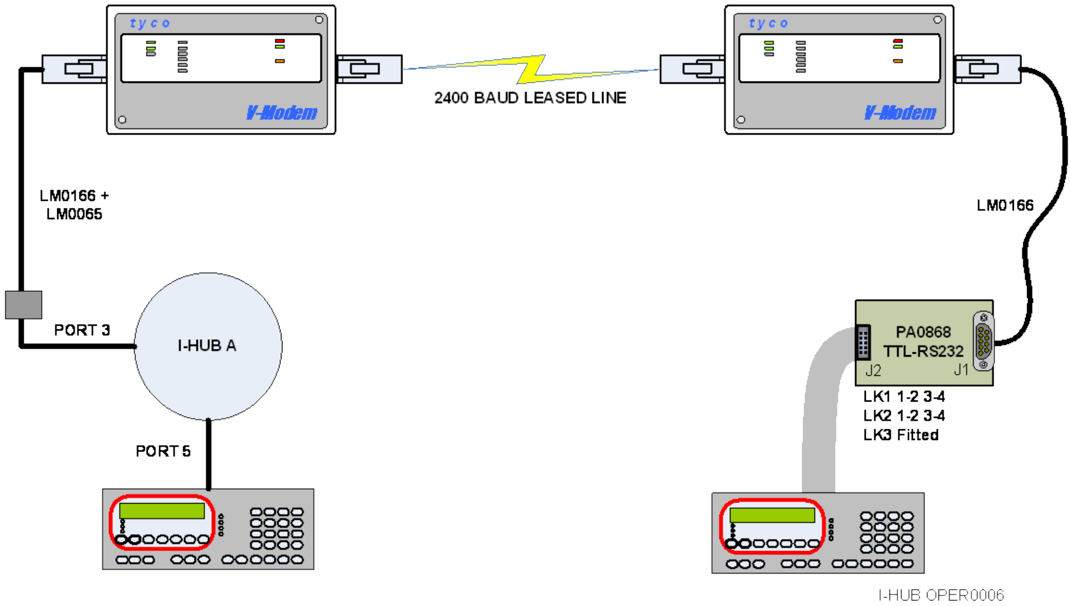


Figure 5.11.4 – Example 4: V-Modem

Table 5.11.4 lists the configuration required for port 3 when using V-Modems to connect a remote FIP.

Table 5.11.4 – Port Setup for Port 3 with V-Modem

ATTRIBUTE	PORT 1	PORT 2	PORT 3	PORT 4	PORT 5
ENABLE	-	-	ENABLE	-	-
MODE	-	-	PNTOPN	-	-
BAUD	-	-	2400	-	-
RXTIME	-	-	2	-	-
TXDELAY	-	-	1	-	-
ACKTIME	-	-	24 *	-	-
DUPTIME	-	-	100 *	-	-
LEADFF	-	-	1	-	-
TRAILFF	-	-	1	-	-
LINKRX	-	-	50	-	-
LINKTX	-	-	0	-	-
ROUTELIDELAY	-	-	0	-	-
RETRIES	-	-	4	-	-
EXPECTBCACK	-	-	ENABLE	-	-
ACKBCAST	-	-	ENABLE	-	-
CONCATMSG	-	-	DISABLE	-	-
SENDMAFST	-	-	DISABLE	-	-
QUEUE	-	-	8000,6000,2800	-	-
LEARNSIDS	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
BCASTIHUBSTATUS	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
HIDEMSGDISCARD	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE

* Note, the ACKTIME and DUPTIME parameter settings may need to be increased if the device being sent to has a response delay/processing delay of more than 200 milliseconds. Refer to the description of the ACKTIME and DUPTIME parameters in section 5.7.3

When modems of any other type or speed are used, the parameter settings must be adjusted according to the baud rate and to allow for any delays in the modem itself. i.e. when data is passed from the I-HUB (or any network device) to a modem (or to any transmitting device), the modem may not start sending it immediately and may also send it in bursts/packets rather than one continuous stream of data.

This can add several hundred milliseconds delay from the time the data leaves the I-HUB to the time it arrives at other network devices (and vice versa). The maximum value of this delay determines the values for ACKTIME and DUPTIME. The value for DUPTIME needs to be set to a value approximately 50 percent longer than the time set by ACKTIME (in milliseconds).

Two situations affect the ACKTIME parameter. These are:

1. A reliable/error free point-to-point link:
   On a reliable point-to-point link the value for ACKTIME is actually not particularly critical because very few errors/retries should occur and if an ACK reply does arrive after the 'ack wait time' has expired the I-HUB will still accept it even though it may be in the process of sending a retry. However, a sensible value for ACKTIME does still need to be set, but its accuracy is not critical.

2. A noisy, error prone, point-to-point link:
   On a less reliable point-to-point link the value for ACKTIME is more important, because the time that the I-HUB spends waiting for an ACK reduces the throughput of data. The 'margin for error' of 400 milliseconds can be left out of the value set for ACKTIME for an error prone point-to-point link.

The value for ACKTIME needs to be set to a value approximately 400 milliseconds greater than the longest time it can take for an ACK to be received at the I-HUB after the I-HUB has transmitted a message requiring an ACK. The value must allow for the worst case time and for the 'worst case' device that will be connected to the port – some devices will respond faster than others. The worst case time probably (but not always) occurs when the remote device has just begun transmitting a 'long' message of its own as it receives the last character of the message from the I-HUB.

The I-HUB starts its 'ACK wait timer' immediately after transmitting the last byte of the message requiring an ACK.

Hence the maximum time it can take for an ACK to arrive back at the I-HUB can be calculated as:

> Max time for the last character of the I-HUB message to arrive at the remote device
> +
> Max time for the remote device to start transmitting an ACK
> +
> Max time for the entire ACK message to arrive in the I-HUB
> +
> 400 milliseconds (safety margin).

The following character times will assist in calculating the value for ACKTIME.

Set Character Transmit Time (CTT) in milliseconds =
1200 baud – 8.3
2400 baud – 4.16
4800 baud – 2.08
9600 baud – 1.04
19200 baud – 0.52

Set max message length (MML) = the maximum size message (in bytes) that the device the I-HUB is SENDING TO can ever send back to the I-HUB. For VIGILANT devices such as MX4428, a value of 100 can be used for this but if the device is not sending events or alarms this may be able to be reduced.

Set max message time (MMT) = CTT times MML.

Set modem delay 1 (MDLY1) = the maximum delay before THE LAST CHARACTER OF ANY MESSAGE transmitted by the I-HUB arrives at the receiver of the network device at the other end (include the delay through both the sending modem and the receiving modem). The value for this may not be easy to determine and may depend on the size of the message being sent by the I-HUB and whether the message is broken up into packets by the modem.

Set modem delay 2 (MDLY2) = the maximum delay from the START of the ack transmission by the remote network device before all characters of the 10 byte ack message arrive at the receiver of the I-HUB (include the delay through both the sending modem and the receiving modem). This also needs to include the time to transmit the 10 characters – this depends on CTT above. The value for this may not be easy to determine and may depend on the size of any previous message sent by the device and whether the message is broken up into packets by the modem.

Set max response delay (MRD) = the maximum time for the remote network device to start transmitting an ACK after all characters of the message sent by the I-HUB have arrived. This value needs to include/allow for the value of MMT above because the remote network device may have just started a transmission of its own as the last character of the message from the I-HUB arrives. For VIGILANT devices such as MX4428 & QE20/QE90, a value of MMT plus 100 can be used for MRD.

The value for ACKTIME can then be calculated as
MDLY1 + MRD + MDLY2 + 400

in milliseconds. This can then be converted to the value for the ACKTIME parameter by dividing by 65 and adding 1.

5.11.4.1 Parameter Settings

The TTL port is configured using port 5 in the programming commands.

The mode may be any of MULTIDROP, PNTOPN (RTS always on) or PNTOPNRTSC (RTS on only while transmitting), according to the application. Some of the critical parameters to be set are as follows.

MULTIDROP mode

LEADFF = 3	
ACKTIME = 45	(units of 65 milliseconds = 3 seconds)
DUPTIME = 150	(units of 33 milliseconds = 5 seconds)
RXTIME = 8	(units of 3 milliseconds = 24 milliseconds)

TXDELAY = 8 (units of 3 milliseconds = 24 milliseconds)
TRAILFF = 1

PNTOPN mode (RTS always on)
LEADFF = 1
ACKTIME = 24 (1.5 seconds)
DUPTIME = 100 (3.3 seconds)
RXTIME = 2
TXDELAY = 1
TRAILFF = 1

PNTOPNRTSC mode (RTS on only while transmitting)
LEADFF = 3
ACKTIME = 24
DUPTIME = 100
RXTIME = 2
TXDELAY = 1
TRAILFF = 1

Other parameters can be left at defaults or set as required.

5.12 I-HUB FAULT MONITORING

5.12.1 PANEL-LINK MESSAGE TYPES USED FOR FAULT REPORTING

Because there are different versions of I-HUB software in the field and several types of device that can connect to an I-HUB, it is useful to understand how an I-HUB reports faults.

For an I-HUB that is connected directly to an *MX1*, no additional configuration is needed in either the I-HUB or the *MX1* in order to monitor the I-HUB's faults. An I-HUB that is not directly connected to an *MX1* requires some additional field configuration to set up the monitoring/ reporting of its faults.

There are two types of Panel-Link messages that an I-HUB may use to report its own faults:

1. Network Application 1 MAF Status message
2. Network Application 3 I-HUB Status message

When a network has one or more *MX1* panels on it, Application 3 I-HUB Status messages are normally used for fault monitoring and none of the I-HUBs need to be configured to send MAF Status messages. Application 3 I-HUB Status messages are understood by *MX1* fire panels, but currently are not understood by any other types of network device, including MX4428 or F3200.

The Application 3 I-HUB Status message includes specific detail on the nature of a fault, allowing an *MX1* fire panel to report the fault with enough detail for a technician to identify the problem using the *MX1* LCD/ keypad, avoiding the need to log in to the I-HUB diagnostic port. In contrast, the Application 1 I-HUB MAF Status message indicates only that there is a fault of some sort, not the type of the fault, and it may be necessary for a technician to use the I-HUB diagnostic port to determine what the fault actually is.

The following configuration command is used to enable the sending of Application 3 I-HUB Status messages on network port x where x is 1, 3, 4 or 5.

```
PORT X BCASTIHUBSTATUS ENABLE
```

For I-HUBs on a ring, each I-HUB should be configured to send its I-HUB Status message on the ring even when there are no *MX1* panels present because these can be monitored at other I-HUBs on the ring and reported on their diagnostics port. Any of the I-HUBs on the ring can then be used to determine where and what the fault is.

I-HUBs prior to software V2.00 did not send Application 3 I-HUB Status messages at all. They report faults using MAF Status messages and did not monitor ring channel break faults. With older I-HUBs, ring channel breaks were monitored using Link Integrity messages.

5.12.2 REPORTING I-HUB FAULTS ON A LOCAL *MX1*

With an *MX1* connected to port 5 and default configuration in the I-HUB, an I-HUB reports any faults it has (e.g., ring channel break) to its local *MX1*. The I-HUB sends its status to the local *MX1* using the Application 3 I-HUB Status message. The I-HUB does not send any MAF status messages because its faults are monitored via the I-HUB status. With default configuration using the *MX1*DEFAULTS command, an I-HUB also sends its I-HUB Status messages onto the ring.

5.12.3 REPORTING I-HUB FAULTS ON A REMOTE *MX1*

If there is no local *MX1* connected to an I-HUB, the Application 3 I-HUB Status message can be sent to a remote *MX1* somewhere else on the network for reporting of any faults. The I-HUB must be configured to send its status onto the appropriate port using the `BCASTIHUBSTATUS` parameter e.g.

```
PORT 1 BCASTIHUBSTATUS ENABLE
```

An I-HUB with no local *MX1* is required to have its own SID number, let's say SID number 99. At the remote *MX1* that is to monitor it, SID 99 should be configured in the "SID Points table" in the *MX1* database with a type set to "Monitored I-HUB" and a SID Config Profile of "I-HUB With SID". The *MX1* then takes care of logging and signalling any faults that I-HUB 99 sends. The *MX1* also monitors the Link Integrity messages sent by I-HUB 99 so I-HUB 99 must be configured to send Link Integrity on the ring by setting the LINKTX parameter for port 1 to 15 (seconds).

```
PORT 1 LINKTX 15
```

5.12.4 REPORTING I-HUB FAULTS WITH MAF STATUS WHEN THERE ARE NO *MX1* PANELS ON A NETWORK

If there is at least one *MX1* panel on the network, then it should be used to annunciate faults for I-HUBs that don't have a locally-connected *MX1*. The *MX1* panel identifies the specific I-HUB that has a fault and also indicates what kind of fault it is, on both the LCD and history log. This is more convenient than connecting a laptop to an I-HUB and can also allow the fault to be reported to a distant off-site location.

If there are no *MX1* panels on the network that Application 3 I-HUB Status messages can be sent to, then Application 1 MAF status messages can be used to report faults. MX4428 and F3200 fire panels are able to monitor Application 1 MAF status messages sent by an I-HUB and can signal any faults the I-HUB has. To make this easier to configure, one specific I-HUB can be configured to monitor all of the Application 3 I-HUB Status messages sent by other I-HUBs on the network using the IHUBFLTMASTER programming command.

```
IHUB IHUBFLTMASTER ENABLE.
```

An I-HUB (let's say SID 98) configured with IHUBFLTMASTER enabled, monitors the I-HUB Status messages sent by all the other I-HUBs and signals a fault in its own MAF status if there is a fault on any other I-HUB. The MAF status sent by I-HUB 98 can then be monitored at an MX4428 or F3200 fire panel. I-HUB SID 98 is then the only I-HUB that needs to be configured to send Application 1 MAF Status messages; other I-HUBs send only Application 3 I-HUB Status messages. This reduces the number of messages that get sent to the MX4428 or F3200 fire panels and requires less field programming.

NOTE 1: An I-HUB that has IHUBFLTMASTER enabled does not include faults from I-HUBs that have a locally connected *MX1* in its status, since the faults from those I-HUBs are already being reported by their local *MX1*. However, if there is an *MX1* panel present then there is no need to have IHUBFLTMASTER enabled for any I-HUB.

NOTE 2: An I-HUB that has IHUBFLTMASTER enabled, monitors the status of other I-HUBs regardless of which network port the I-HUB status is received on.

5.12.5 MESSAGE FILTERING OF I-HUB FAULT STATUS

On an I-HUB ring, each I-HUB should be configured to send its Application 3 I-HUB Status on the ring. When an I-HUB is configured using the MX1DEFAULTS command, all messages received from the ring get sent to port 5 of the I-HUB, including I-HUB Status messages. If the device on port 5 is an *MX1* this is fine (and sometimes necessary). If the device on port 5 is not an *MX1*, it may be desirable to not send I-HUB Status messages on that port for all I-HUBs on the ring. This can be achieved by filtering Application 3 messages in the I-HUB e.g.:

```
PORT 1 PASSAPP 0,1,2,4,5,6,9 TXPORT 5
```

If the device on port 5 is an MX4428 then the Applications that should be passed to it are 0, 1, 4, 6, and 9.

```
PORT 1 PASSAPP 0,1,4,6,9 TXPORT 5  ; MX4428 on port 5
```

If the device on port 5 is an F3200 then the Applications that should be passed to it are 0, 1, 2, 4, 6, and 9. Application 2 is needed only if the F3200 is logging events for other network devices.

```
PORT 1 PASSAPP 0,1,2,4,6,9 TXPORT 5  ; F3200 on port 5
```

5.13 MIXING I-HUB V1.XX AND V2.XX SOFTWARE ON A RING

It is not recommended to mix I-HUB version 1.XX and version 2.XX software on the same ring because this can make fault finding slightly harder as described below.

I-HUB V2.XX software behaves differently to V1.XX software regarding the handling of Link Integrity messages that are routed from non-ring ports onto the ring. V1.XX software sends routed Channel A Link Integrity messages only on ring Channel A and routed Channel B Link Integrity messages are sent only on ring Channel B. V2.XX software sends routed Channel A messages on both channels of the ring and routed Channel B messages are also sent on both channels. On a ring with all V1.XX I-HUB software, when a single break occurs in the ring, numerous Link Integrity faults get reported, some for Channel A and some for Channel B. The location of the fault can be determined by looking at which devices produce a Channel A fault and which devices produce a Channel B fault. If one of the I-HUBs has V2.XX software, a single break in the ring does not result in any Link Integrity faults for the routed Link Integrity messages sent onto the ring by that I-HUB. This needs to be allowed for when inspecting the list of Link Integrity faults to determine the location of the break. If the break is adjacent to an I-HUB with V2.XX software, the I-HUB reports the fault in its MAF Status and I-HUB Status messages.

For example, suppose there is a break between two I-HUBs running V1.XX software with associated SID numbers 4 and 5 for which Link Integrity is being passed onto the ring. A device somewhere else on the ring that is monitoring Link Integrity for all panels, will report Link B faults for "all devices" between itself and "SID 4" and Link A faults for "all devices" between itself and "SID 5" in the opposite direction. "All devices" excludes devices connected to an I-HUB running V2.XX software.

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6 I-HUB DIAGNOSTICS

6.1 GENERAL INFORMATION

I-HUB port 4 supports a diagnostics terminal that can be used to display diagnostic information. This can be very useful in identifying network issues. The I-HUB is in diagnostic mode whenever the I-HUB is powered up, running and not in programming mode.

> Note: Port 4 is the primary I-HUB diagnostic port. If port 4 is enabled for network operation, then diagnostics and message monitoring reverts to port 5, if port 5 is not configured as a network port. In order to use port 5 as the diagnostic port, a suitable TTL/RS232 converter such as PA0868 is required.
>
> Note that site-specific data programming is always carried out on port 4.

To access the I-HUB diagnostics connect a terminal or terminal emulation program running on a PC to the diagnostic port (refer Section 3.2). Type the Enter or Return key to show the `I-HUB DIAG>` prompt; to display Help press the 'H' key. The Help display is as follows:

```
I-HUB V2.00          (c) 2013 Tyco Australia Pty Ltd.  All rights reserved.
Runtime Diagnostics                                                 SID 213

'H' : Help
'I' : General status of this I-HUB
'F' : Current faults/warnings on all I-HUBs
'L' : Log of status events on all I-HUBs
'A' : Status report of all I-HUBs
'E' : Reset 30-min error count totals globally

'G' : Go into programming mode
'D' : Display stored configuration

'P' : Panel-link mac message monitor
'C' : Network performance counters
'Q' : Queue status

Following are advanced commands for TFPP use only
'S' : Stack usage display
'T' : Task times
'MHUB!'  : Memory Diagnostics
'MHUB|+' : Reset
'XHUB'   : Test Message generation
```

From the runtime diagnostics, with the 'G' command it is possible to restart the I-HUB in programming mode (note – the I-HUB will stop network communications).

The programmed configuration can be displayed with the 'D' command.

The other commands are explained in the following sections.

Many of the displays available from the diagnostics terminal utilise a paging mechanism so that only one screen's worth of information is shown at a time. Prompts such as this:
`--- MORE (press space to continue, 'X' to exit, 'A' for all) ---`
or
`--- END (press any key) ---`
may be seen. Pressing the spacebar will continue with the next screen of information for both. For the former prompt, pressing 'X' will abort the display of information, and 'A' will remove all further prompts and display all remaining information at once.

6.2 GENERAL I-HUB STATUS

Entry of the 'I' command at the diagnostics prompt will produce a display of the local I-HUB's status. For example:

```
General I-HUB Status
====================
I-HUB SID:                           102

Network date/time is:                24/06/12 21:54:40

PSU fault:                           no
Ring break (port 1):                 no
Ring break (port 2):                 no
30-min error count total (port 1):   0
30-min error count total (port 2):   0
Highest SID learnt:                  102

Error count bins (minutes ago) for port 1:
 0:   0,  1:   0,  2:   0,  3:   0,  4:   0,  5:   0,  6:   0,  7:   0,
 8:   0,  9:   0, 10:   0, 11:   0, 12:   0, 13:   0, 14:   0, 15:   0,
16:   0, 17:   0, 18:   0, 19:   0, 20:   0, 21:   0, 22:   0, 23:   0,
24:   0, 25:   0, 26:   0, 27:   0, 28:   0, 29:   0

Error count bins (minutes ago) for port 2:
 0:   0,  1:   0,  2:   0,  3:   0,  4:   0,  5:   0,  6:   0,  7:   0,
 8:   0,  9:   0, 10:   0, 11:   0, 12:   0, 13:   0, 14:   0, 15:   0,
16:   0, 17:   0, 18:   0, 19:   0, 20:   0, 21:   0, 22:   0, 23:   0,
24:   0, 25:   0, 26:   0, 27:   0, 28:   0, 29:   0
```

The I-HUB SID displayed will be that explicitly configured for the I-HUB or that "borrowed" from a supporting device. If the SID is borrowed it will have "`(borrowed)`" after the number. When the I-HUB is configured to borrow a SID and it has been unsuccessful in obtaining a SID the text "`none (trying to borrow)`" will be displayed.

The PSU fault, Ring break (port 1) and Ring break (port 2) lines indicate the current status of these items.

The highest SID learnt will be displayed only if the SID learning functionality is enabled on at least one port. This could be used to determine unused SID numbers to allocate to a new device being added to an existing network.

Items related to error counts are for the ring ports only, and will be displayed only if ring operation is enabled. An error count will increase by one for each ring transaction that is not completed. The 30-min error count totals are the number of errors for the last 30 minutes on each port. The error count bins show the number of errors in each minute for the last 30 minutes. The ring 30 minutes error counts can be reset (for all I-HUBs) with the 'E' command.

6.3 STATUS REPORT OF ALL I-HUBS

The 'A' command will display a status report for all I-HUBs for which this I-HUB is receiving I-HUB status messages.

```
SID        Version    Status           Ring 30-min Error Count Total
                                           Channel 1   Channel 2

1   *      2.00       Fault                0           0
102        2.00       Fault + Warning      0           0
```

For each I-HUB the following is shown:

- Its SID – the local I-HUB is indicated with an asterisk.
- Software version (note that only I-HUB V2.00 and above report their status).
- Status summary – it can be Normal or Fault and/or Warning. Use the 'F' command to interrogate the I-HUB's status further.
- Ring 30 minute error count totals.

The ring 30 minute error count totals can be reset with the 'E' command at the runtime diagnostics prompt. This will send a broadcast message to all I-HUBs instructing them to reset their ring error counts.

6.4 I-HUB STATUS DISPLAY AND LOGGING

The 'F' command from the diagnostics prompt can be used to display the current faults/warnings on I-HUBs that this I-HUB is receiving I-HUB status information from. The display looks like this:

```
Current Faults/Warnings on All I-HUBs:

This I-HUB (SID #1):
    PSU fault

SID #102:
    PSU fault
    Multi-drop port access problem
```

Only I-HUBs with warnings and/or faults will appear in this display. Also only those faults currently present are displayed.

The 'L' command from the diagnostics prompt can be used to display a chronological list of faults/warnings from the I-HUBs up to the current time, like that shown below:

```
Date/Time            SID  Event Description

25/06/12 02:59:02    102  PSU fault cleared
25/06/12 02:58:58  *   1  PSU fault cleared
25/06/12 02:43:40  *   1  PSU fault
25/06/12 02:43:25    102  PSU fault
25/06/12 01:32:55    102  Multi-drop port access problem
25/06/12 01:32:47  *   1  Time changed - new time
01/01/90 00:00:11  *   1  Time changed - old time
```

The log holds up to 200 entries, at which point the oldest entries are discarded.

Possible faults displayed are:

- Local PIB fault – a PIB connected to the I-HUB has a fault. Use the diagnostics on the PIB to find out more.
- Remote PIB fault – a PIB connected to the I-HUB has detected a fault at another PIB. Use the diagnostics on that PIB to find out more.
- Ring break on channel 1
- Ring break on channel 2
- Hardware fault – the EEPROM containing the programmed configuration has become corrupted.
- PSU fault – the PTT (PSU fault) input was operated.
- Neighbouring I-HUB has no SID
- This I-HUB has no SID
- Message discard on port x
- Queue overflow on port x
- Ring pass-thru queue overflow on port x
- Generic fault – a fault has been generated by a newer version of I-HUB software that this I-HUB doesn't understand.

Possible warnings are:

- Multi-drop port access problem – continuous collisions are occurring on a multi-drop port when the I-HUB is attempting to make a transmission.
- Queue warning on port x – queue is close to overflow on port x
- Generic warning – a warning has been generated by a newer version of I-HUB software that this version doesn't understand.

When a condition clears, the chronological log will display the condition with "cleared" appended to it.

When the network time changes, the log will display "Time changed - old time" with an old timestamp, and "Time changed - new time" with the new timestamp.

When the I-HUB stops receiving I-HUB status messages from another I-HUB, the log will contain a "No longer reporting status" message. If it begins reporting again within 18 hours, the log will contain a "Sending status again" message.

If queue warnings, queue overflows, and message discards are occurring, this is an indication that too much data is being transmitted for a given transmission speed, or that poor cabling and electromagnetic interference are causing problems with received messages, or that the device on that port has failed, become disconnected or powered down. A stable, well-behaved network should not exhibit any of these events.

6.5 PANEL-LINK MAC MESSAGE MONITOR

The Panel-Link MAC (Media Access Control) Message Monitor can display messages received and or transmitted on selected ports. Furthermore the Message Monitor can display messages received or transmitted for selected SIDs. The Message Monitor can be used as an aid to identifying system configuration issues.

It is necessary to have some knowledge of the Panel-Link message format if sense is to be made of the Panel-Link MAC Message Monitor output.

6.5.1 MESSAGE FRAMING

Panel-Link protocol 'data' is encapsulated by a 'transport' layer frame. In this document this is referred to as the MAC layer.

MAC LAYER FORMAT

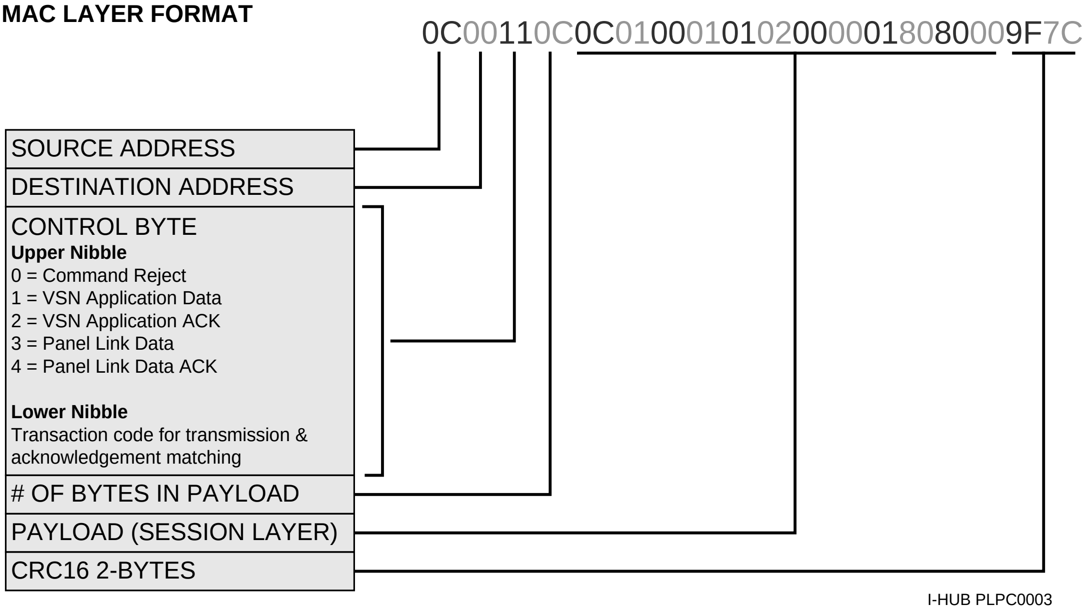

Figure 6.2.1 – MAC Frame Format

Figure 6.2.1 shows an example MAC frame and its format. The output from the MAC Message Monitor is ASCII hex. Two digits are used to represent each byte of data. The example 'message' was taken from an I-HUB connected to a FIP with a SID of 12 ($0C_{hex}$). It can be seen from Figure 6.2.1 that the Source Address is SID 12 ($0C_{hex}$) and so originated from the FIP. As the Destination Address is zero (0), this message is a 'broadcast' message. Since the upper nibble in the control byte is one (1), the MAC layer message contains VSN (Vigilant System Network) Application Data. The lower nibble is the transaction number from the FIP. Each message originating from a FIP or I-HUB contains an 'incrementing' transaction number which is used for acknowledgement matching. The number of bytes in the payload portion of the message is 12 ($0C_{hex}$)

Figure 6.2.2 shows the payload portion of the previous message example and is the Panel-Link data. The payload is referred to as the 'session' layer.

SESSION LAYER FORMAT

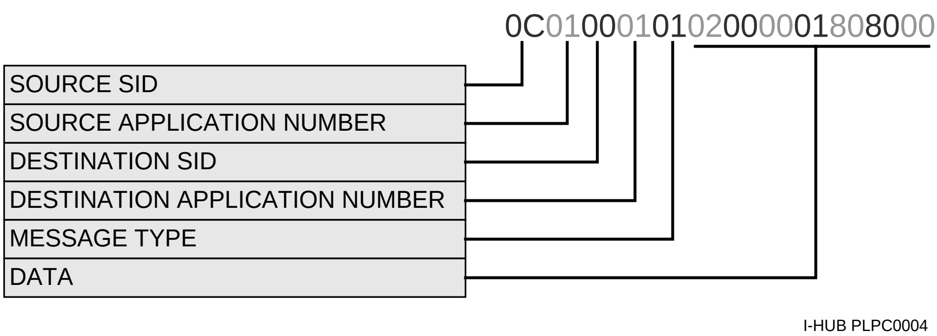

Figure 6.2.2 – Session Layer (payload) Frame Format

The first byte identifies that the payload originated from a Source SID of 12 (0Chex) and that the Source Application Number is one (01). Allocation of Application Numbers is shown in Table 5.7.1. The Destination SID is zero, thus identifying this message as a 'broadcast' message. The Destination Application Number is also one (01).
Since the Application Number is 1, this message is a MAF Status Message.

Discussion of the data portion is beyond the scope of this document.

Identifying Other Message Types

ACK Messages

An example Acknowledgement message is shown in Figure 6.2.3. The ACK message is generally the shortest message that will be observed using the MAC Message Monitor. The ACK is transported at the MAC layer level (in the control byte) and therefore the COUNT byte is zero.

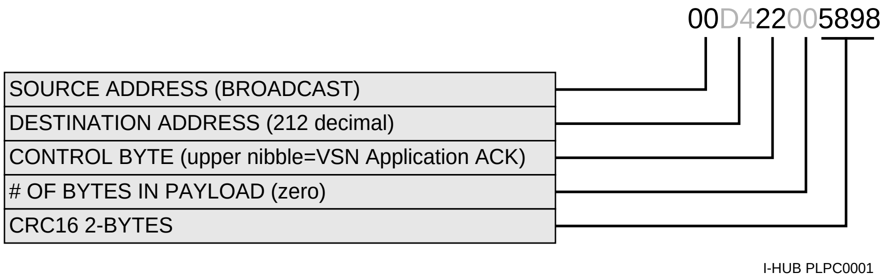

Figure 6.2.3 – ACK Message Format

As can be seen from Figure 6.2.3, the upper nibble in the control byte is 2. From the definitions for the Control Byte (shown in Figure 6.2.1) this indicates that the message is an ACK message. Note the source address is 00 (broadcast) as the original message was a broadcast (to 00), so to match the original message a source address of 00 must be used.

Link Integrity Messages

Link Integrity messages are usually transmitted in channel A and channel B 'pairs'. Figure 6.2.4, shows an example of a pair of Link Integrity messages being sent from the FIP with a SID of 12 (0Chex).

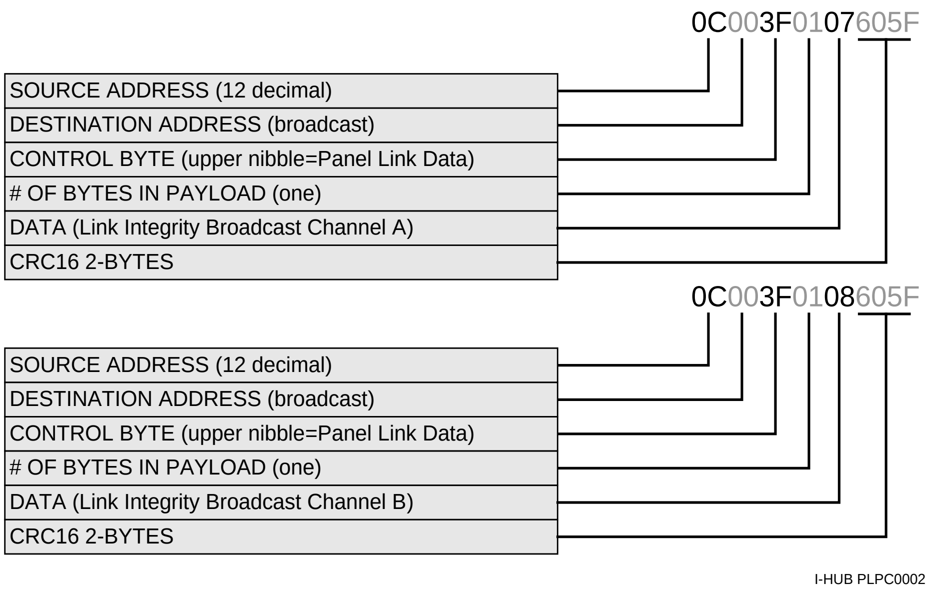

Figure 6.2.4 – Link Integrity Message Format

The Link Integrity messages have a payload byte count of 1. The payload byte in the top example is 07, which defines the message as a Link Integrity broadcast on channel A. In the lower example, the payload byte is 08, which defines the message as a Link Integrity broadcast on channel B.

Message Structure on the Ring

For a message on the ring, the source address and destination address have a different meaning. The source address is the address of the ring node which first placed the message onto the ring. The "dest address" is a modulo 256 "message_number" which remains the same as the message is repeated around the network. In conjunction with the source address, this is used to detect when messages meet after being sent in both directions. For link integrity messages on the ring, the fifth byte of the message is "7" or "8" indicating the channel number and the sixth byte is the source address of the sid that the link integrity message was originated by.

6.5.2 RECEIVE AND TRANSMIT MESSAGE MONITORING

The message monitor is selected by pressing the 'P' key at the diagnostics prompt. The MAC Message Monitor shows the following menu:

```
Panel-link message monitor select.
'SPACE'=toggle display msgs  '1'=debugq msg discard count
'L'=SID link integ rx status 'S'=set SID number
'D'=display selections       'A'=set application number
'Q'=quit to main menu
'RA'=monitor All receive     'TA'=monitor All transmit
'RN'=monitor None receive    'TN'=monitor None transmit
'Rn'=toggle monitor rx port n(1-5)
'Tn'=toggle monitor tx port n(1-5)
```

For each I-HUB port that is ENABLED, either transmitted, and, or received messages can be monitored/displayed. For example, the 'RA' (Receive All) option allows the display of received messages for all enabled ports. The 'Rn' option TOGGLES receive monitoring for port n.

The 'TA' option (Transmit All) displays transmitted messages for all enabled ports. The 'Tn' option TOGGLES transmit monitoring for port n.

The SPACE key stops or starts the display of messages.

On a busy system the monitoring queue will often become full and not all messages will be shown. The '1' option will display the number of messages that were discarded because the monitoring/debug queue was full. Note, if the number of discards is non-zero, the display of messages will pause, otherwise the display of messages will continue.

The 'D' option will display the current port selections – for example:

```
Port 1  Receive=N  Transmit=N
Port 5  Receive=N  Transmit=N

Monitoring all SIDs.

Monitoring all applications.
```

The selections will also be displayed each time they change.

6.5.3 SELECTIVE SID MONITORING

The 'S' option allows the entry of a single SID 'address' to enable the display of only those messages that contain that SID in any of its header fields.

Entering a SID number of 256 will resume display of all SIDs.

6.5.4 SELECTIVE APPLICATION MONITORING

The 'A' option allows the entry of a single application number to enable the display of messages for that application only.

Entering a number of 256 will resume display of messages with any application number.

Entering a number of 257 will display only non-application messages (Link Integrity, ACK, and query ID).

6.5.5 DISPLAYING THE LINK INTEGRITY STATUS OF I-HUB KNOWN SIDS

The 'L' option displays the Link Integrity status of all the SIDs that are explicitly programmed in the I-HUB configuration, as well as all automatically learnt SIDs.

```
SID   1  PORT 1  CHA ok    CHB ok
SID   3  PORT 1  CHA ok    CHB ok
SID   8  PORT 1  CHA ok    CHB ok
SID  12  PORT 5  CHA ok    CHB ok
SID  52  PORT 1  CHA ok    CHB ok
SID  58  PORT 1  CHA ok    CHB ok
```

Note that not all SIDs will be sending Link Integrity to (or thru) the I-HUB and these will appear as failed. This is a diagnostic command only.

6.6 NETWORK PERFORMANCE MONITORING

Command 'C' from the diagnostic menu displays the following menu followed by a list of network performance counters for each enabled network port.

```
SPACE=Panel-Link counters  C=Clear counters  N=names
Q=quit to main menu
```

The SPACE key may be used to display 'Panel-Link' counters as shown in the following example.

```
PORT 1  CD=0  NA=0  DIS=0  HO=0
    TA=8  TNA=0  RC=0  DD=0  RX=1
    RXFULL=0  ATXQF=0  RLIQF=0  LTXQF=0
    RTXQDIS=0  RQNUMW=0  RQMAXB=54
    INCMPL=0  FRAME=0  PARITY=0  OVERRUN=0

PORT 2  CD=0  NA=0  DIS=0  HO=0
    TA=11  TNA=0  RC=0  DD=0  RX=0
    RXFULL=0  ATXQF=0  RLIQF=0  LTXQF=0
    RTXQDIS=0  RQNUMW=0  RQMAXB=0
    INCMPL=0  FRAME=0  PARITY=0  OVERRUN=0

PORT 5  CD=0  NA=0  DIS=0  HO=0
```

```
TA=0  TNA=13  RC=0  DD=0  RX=13
RXFULL=0  ATXQF=0  RLIQF=0  LTXQF=0
RTXQDIS=0  RQNUMW=0  RQMAXB=13
```

For each port there is a list of counters each preceded by a name. The values of all the counters have a maximum value of 4,294,967,295 and will automatically roll over to zero after this.
Ring ports have some counters displayed that other ports do not.

The meaning of each name can be seen by using the 'N' key, i.e.

```
CD          =Collisions
NA          =Not ackd
DIS         =Discarded
HO          =Holdoff
TA          =Msgs txd requiring ack
TNA         =Msgs txd not req. ack
RC          =RX crc errors
DD          =Dup detect
RX          =Total rx msgs
RXFULL      =Serial rx int buff full
ATXQF       =Ack tx queue full
RLIQF       =Routed link integ queue full
LTXQF       =Local tx queue full
RTXQDIS     =Route tx queue discards
RQNUMW      =Routed queue number of warnings
RQMAXB      =Routed queue max bytes used
INCMPL      =Incomplete blocks
FRAME       =Framing error
PARITY      =Parity error
OVERRUN     =Overrun error
RRXQF       =Ring rx queue full discards
RTXQF       =Ring tx queue full discards
RPQMM       =Ring passthru queue max q'd msg count
```

CD - Collisions
When operating in a half duplex mode (RS485), data collisions may occur if two devices attempt to transmit at the same time. Collisions are detected by the I-HUB hardware interface at the RS485 signal level and if occur will cause the I-HUB transmitter to "back-off" before making another attempt. Each time a collision is sensed the CD (collision) counter is incremented. Cable faults, an incorrectly terminated RS485 bus or random noise can all contribute to data collisions in an otherwise good network.

NA – Not Acknowledged
If I-HUB does not receive an acknowledgement to a message that it expects to, it increments the NA counter before sending the message again. If NA is steadily increasing, it means the device supposed to be acknowledging messages is turned off, disconnected, or not programmed to acknowledge broadcasts. The source of random NA counts can be caused by a device being overloaded, busy, or collisions.

DIS – Discarded
When the message retry counter for a port is exhausted (i.e. as set by the `PORT n RETRIES v` command for non-ring ports) the message 'discarded' counter is incremented and the message is then discarded.

HO – Holdoff
If the port transmitter cannot transmit after a certain number of times, then it will attempt to slow the transmission down in case in an effort to reduce the potential for network hogging.

TA – Number of Messages Transmitted Requiring An ACK
Each time a message requiring an Ack is sent by the I-HUB on a specific port the TA counter is incremented.

TNA – Number of Messages Transmitted Not Requiring An ACK
Each time a message not requiring an acknowledgment is transmitted this counter is incremented.

RC – CRC Errors
Each received message is checked for a correct CRC, and if there is a CRC error the message is rejected and the RC counter is incremented.

DD – Duplicate Message
If a duplicate message is received within the time set by the `PORT n DUPTIME t` command, the DD counter is incremented.

RX – Total Received Messages
This is the total number of messages received by the I-HUB on this port.

RXFULL – Receiver Interrupt Buffer Full
Whenever more data arrives into an I-HUB port buffer than can be accommodated, then the buffer is overrun and the RXFULL counter is incremented. As the I-HUB buffer sizes are quite large, this indicates a very overloaded system.

ATXQF – ACK TX Queue Full
This counter is incremented whenever the I-HUB tries to ACK a message and cannot place it in the transmitter queue.

RLIQF - Routed Link Integrity Queue Full
Each time the I-HUB cannot place a message in the queue for routed Link Integrity messages it will increment this counter.

LTXQF - Local TX Queue Full
If the I-HUB attempts to place more data than can be accommodated into a transmit queue, then the buffer is stalled and the LTZQF counter is incremented.

RTXQDIS - Route TX Queue Discards
If the I-HUB attempts to place more data than can be accommodated into a routing transmit queue, then the buffer is stalled and the RTXQDIS counter is incremented.

RQNUMW - Routed Queue Number Of Warnings
This is the number of times that a queue has reached the warning level and subsequently cleared.

RQMAXB - Routed Queue Max Bytes Used
This is the peak or maximum number of bytes that have been used to accommodate buffered messages. A high number in the upper 25% of the buffer allocation is of concern as the buffer is operating close to its limit leaving little room for margin or peak loading.

INCMPL - Incomplete Blocks (ring ports only)
This counter will increment for each ring networking frame received that is incomplete.

FRAME - Framing Error (ring ports only)
This counter will increment for each character received where no stop bit is detected.

PARITY - Parity Error (ring ports only)
This counter will increment for each character received where the parity check fails.

OVERRUN - Overrun Error (ring ports only)
This counter will increment for occurrence where the integrated communication processor receive FIFO buffer is overrun.

In general if any counters other than TA, TNA or RX are incrementing, then this indicates an incorrectly configured or overloaded system.
The 'C' option can be used to clear/zero all of the counters for all ports by responding 'Y' to the prompt.
```
Clear all counters? [Y/N]
```

Responding with Y will clear and redisplay all counters.

6.7 QUEUE STATUS

Pressing 'Q' from the diagnostics prompt displays for each network port the size (in bytes) of the main transmit queue, the amount of data currently waiting in the queue (in bytes), and the highest amount that has ever been waiting in the queue. For example:
Port 1 : rqueue size=8192 bytes used=0 max used=280
Port 3 : rqueue size=8192 bytes used=7700 max used=8191
WARNING! bytes used exceeds warning level
queue full/discard event has occurred.
queue warning event has occurred.
Port 4 : rqueue size=8192 bytes used=0 max used=303

"rqueue size" = the total number of bytes the queue can hold.
"bytes used" = the number of bytes currently waiting in the queue.
"max used" = the largest value that "bytes used" ever got to.

The value "max used" is also shown in the network diagnostic counter data as "RQMAXB", described in the section 'Network Performance Monitoring' above.

The above example also shows some additional information for port 3 that indicates the following:

"WARNING! Bytes used exceeds warning level"
This message means that the amount of data waiting in the queue is greater than the 'warning level' (default 6000 bytes).

"queue full/discard event has occurred."
This message means that at some time in the past, the queue had become completely full and one or more messages had to be discarded.

"queue warning event has occurred."
This message means that at some time in the past, the queue size has exceeded the warning level.

The value of 'RQNUMW' shown in the diagnostic counter data indicates the number of 'warnings' that have occurred. A 'warning state' occurs when the queue exceeds the warning level (default 6000 bytes) and the 'warning state' is cleared when the amount of data in the queue falls below the warning clear point (default 2800 bytes). RQNUMW indicates how many times this has happened.

The value of RTXQDIS in the diagnostics counter data is the total number of messages that have been discarded because the queue was full.

6.8 DIAGNOSTIC LEDS

The I-HUB has 7 diagnostic LEDs, as follows:

a) 2 x RS485 Rx LEDs (Amber, LD5 & LD7), one per channel, which blink on reception of any data on the appropriate port 1 or 2 channels.

b) 2 x RS485 Tx LEDs (Amber, LD4 & LD6), one per channel, which blink when the I-HUB transmits information onto the appropriate port 1 or 2 channels.

c) Panel-link message LED (Red, LD1) which blinks when valid Panel-link MAC frames are received by the I-HUB or it sends a Panel-Link message.

d) Run LED (Amber, LD2) which flashes half a second on, half a second off, when the I-HUB is running and not in program mode.

e) Reset Indicator (Green), which should normally be on steady. If it is off or flashing, the I-HUB is turned off or has a hardware fault.

In ring mode the port 1 and 2 Rx and Tx LEDs should appear to be on continuously (flashing on and off faster than the eye can see). If these LEDs are flashing on/off slowly (every 0.5 seconds to 1 second) then this indicates a problem on the ring connection.

In non-ring mode the port 1 and 2 Rx and Tx LEDs indicate data received or transmitted respectively. If any are always off, then generally there is a problem (or the port is disabled). If any are always on there is definitely a problem. Under normal operation they should blink with message activity.

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7 NETWORK DEVICES

7.1 *MX1* FIRE PANELS

7.1.1 I-HUB PROGRAMMING

The `MX1DEFAULTS` factory default configuration (I-HUB V2.00 firmware onwards) will work unchanged for *MX1* fire panels that are connected to I-HUB port 5 operating at 38400 bps with the I-HUB connected to a ring operating at 57600 bps.

The SID of the *MX1* will be "borrowed" by the I-HUB. If an I-HUB port other than 5 must be used then modifications to the configuration will be required, and the I-HUB must be allocated a SID of its own.

7.1.2 *MX1* PROGRAMMING

A *MX1* fire panel is configured to use an I-HUB by selecting the I-HUB function for the Network equipment address on the Hardware page as shown in Figure 7.1. By default only one profile is available for 38400 bps, new profiles may be created if this baud rate is not suitable.

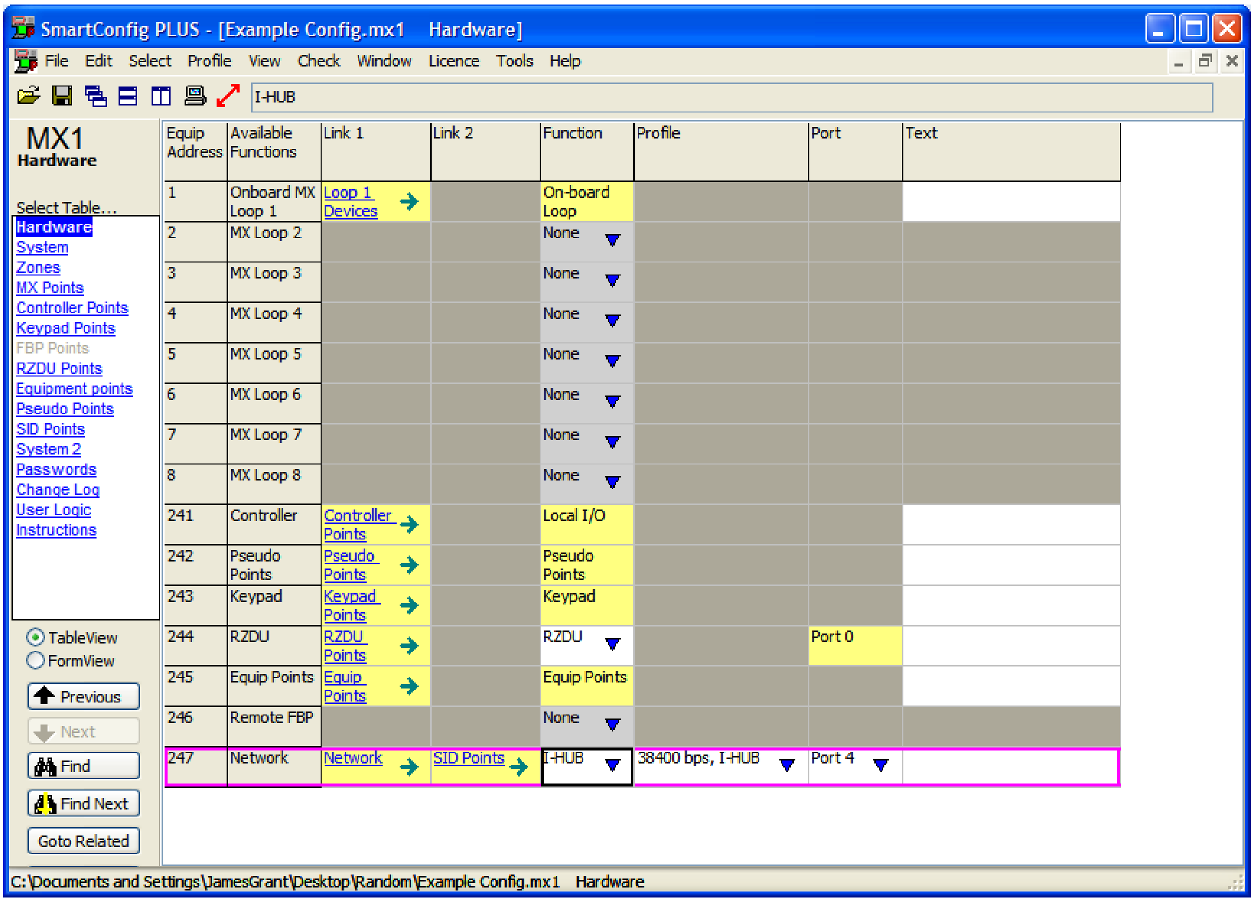

Figure 7.1 – Configuring an *MX1* to connect to an I-HUB.

The *MX1* fire panel has its SID configured on the System page in the Network section. The I-HUB will 'borrow' this SID if it is configured to do so.

The status of the local I-HUB is given on the 241.32.x Controller points. Refer to the *MX1* Operator Manual (LT0439) for the definitions.

7.2 MX4428 FIRE PANELS

7.2.1 I-HUB PROGRAMMING

The `MX4428-MULTIDROP` and `MX4428-RING` configurations can be used for connection to an MX4428. The I-HUB must be allocated its own SID. See sections 5.9.3 and 5.9.4. Note that Panel-Link applications 0,1,4,6,9 are the only applications that need to be passed to MX4428.

7.2.2 MX4428 PROGRAMMING

Careful network traffic analysis will determine where potential overloading of centralized fire panels will occur. Irrespective of the panel model or type, potential trouble can occur if a centralized fire panel is unnecessarily overloaded with the task of monitoring network integrity, system data from other FIPs in the network, as well as supporting a heavy load of local sensors, indicators and equipment.

It may be necessary in large applications (networks) to share the load at the central location across multiple FIPs.

Figure 7.2 shows a typical MX4428 Network Configuration window using SmartConfig.

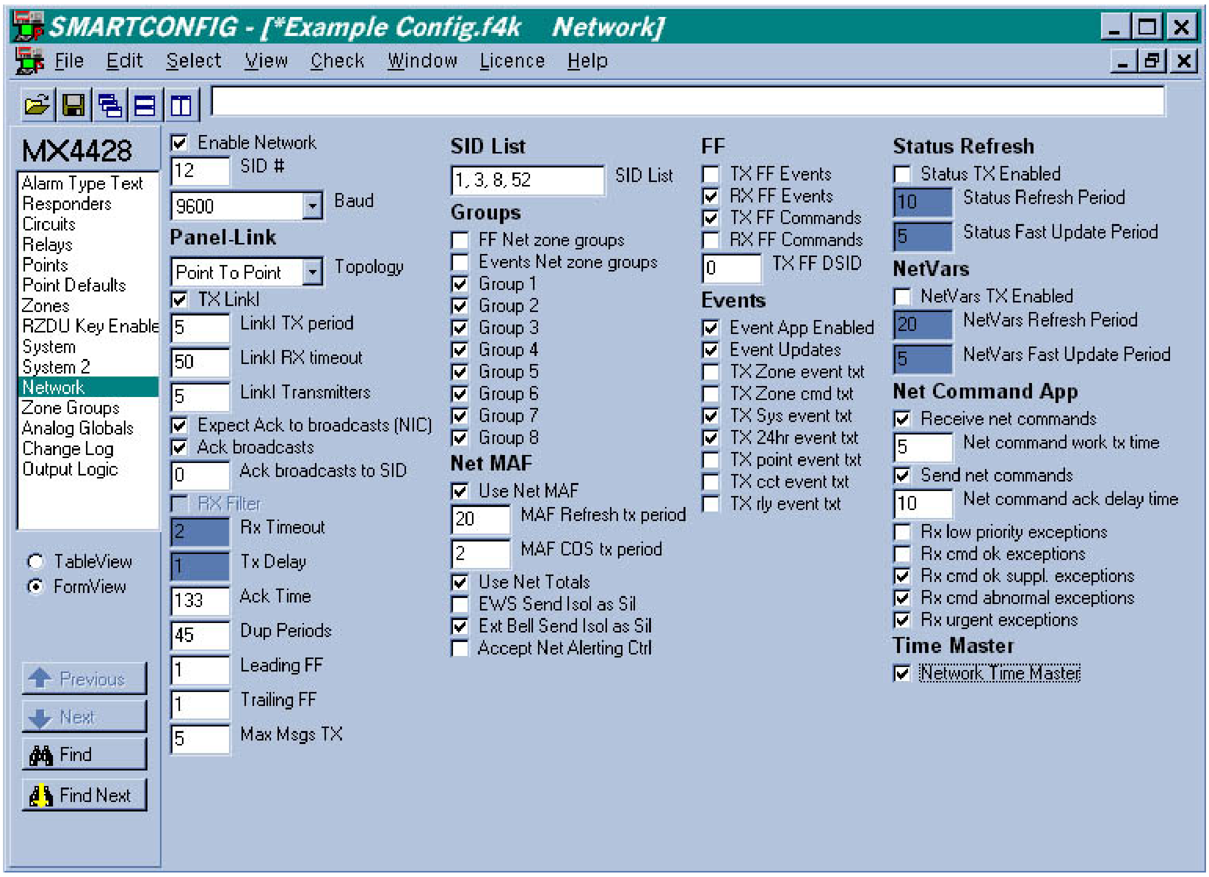

Figure 7.2 – Typical MX4428 SmartConfig Window

To use the MX4428 in a network, check the "Enable Network" box. The baud rate of the MX4428 network port should be set to 9600 baud. The baud rate of the I-HUB's port must be programmed to match this.

Network "Topology" should be set to match that of the method being used to connect the MX4428 to the network. In the example this is a "Point-to-Point" connection.
Tests have indicated that an MX4428 lightly loaded with responders, but with the maximum number (33) of LED display modules present with logic, can handle a sustained rate of 15 messages per second.

7.3 F3200 FIRE PANELS

7.3.1 I-HUB PROGRAMMING

The `MX4428-MULTIDROP` and `MX4428-RING` configurations can be used for connection to an F3200. The I-HUB must be allocated its own SID. See sections 5.9.3 and 5.9.4. Note that Panel-Link applications 0,1,4,6,9 are the only applications that need to be passed to F3200 unless F3200 is doing network event printing.

If the device on port 5 is an F3200 or NDU that is doing network event logging or has a network zone LED mimic display then application 2 messages must also be sent on port 5 so the following command must be included.

```
PORT 1 PASSAPP 2 TXPORT 5
```

7.3.2 F3200 PROGRAMMING

Any F3200 on the Panel-Link Network needs to be configured to work correctly with the I-HUB. The printout below is an example of a point-to-point configuration suitable for connection to an I-HUB.

```
________________________________________________________________________________

Network Configuration
________________________________________________________________________________

Network operation    : enabled
Point access         : disabled
SID                  : 1
MODE                 : Pnt to pnt
NIC                  : Yes
RX Timeout           : 2
TX Delay             : 1
ACK Time             : 800
DUP Time             : 2000
Leading FF           : 1
Trailing FF          : 1
Link TX              : Yes
Link TX Time         : 5
Link RX Time         : 50
Groups               : [12345678]
ACK Broadcasts       : Yes
Baud rate            : 9600
Retries              : 5
Slots                : 8
ModeB                : 3
ACK bcasts to SID    : 0

________________________________________________________________________________

Network SID Configuration

SID     Link     Log     RX       TX       RX      Use MAF  Use MAF   Status
         RX     Events  FF       CMD      CMD     RLY Data Totals    Search
________________________________________________________________________________

3        Yes     Yes     No       No       Yes      No       No        Yes
8        Yes     Yes     No       No       Yes      No       No        Yes
```

```
12      Yes     Yes     No      No      Yes     No       No       Yes
52      Yes     Yes     No      No      Yes     No       No       Yes
```

```
Network MAF Config
```

```
Refresh TX time : 20
Max COS rate    : 2
Receive net warning sys silence : Yes
Send net warning sys silence : No
Receive net external bell silence : Yes
Send net external bell silence : No
```

```
Network Command Config
```

```
Receive net time/date : Yes
Send net time/date : No
Ack time   : 10
Work time  : 3
```

```
Network FF Config
```

```
TX Alarms        : Yes
Dedicated TX SID : 0
```

```
Network Event Config
```

```
Transmit events           : Yes
Transmit event updates    : No
Zone/Relay Cmds Text TX   : No
Zone/Relay Events Text TX : No
System Events Text TX     : Yes
Transmit relay operate events : Yes
```

```
Network Variable Config
```

```
TX enabled      : No
TX Refresh rate : 20
Max COS rate    : 5
```

```
Status Config
```

```
Status refresh enabled : No
TX Refresh rate        : 23
Fast update TX rate    : 7
```

7.4 OTHER NETWORK DEVICES

Various other VIGILANT Panel-Link devices are compatible with an I-HUB network. Please refer to the respective manuals for Network configuration details.

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