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1 Introduction

The purpose of this addition to the Freeway User Guide is to update the information relating to the system control module. Pro-Bel has recently added a new router to its range, Sirius, which has inherited the Freeway features, and built upon them. This development has required that the Freeway system control module hardware and software be modified and that a revised version of the router database editor be released. This is the reason that the editor name has changed from 'Freeway' to 'Pro-Bel Router' editor. This change has also resulted in the control module now being supplied with Freeway having new software, and a different physical appearance. This supplement to the Freeway user guide will clarify all settings for both existing and new systems.

1.1 Control module types

1.1.1 2440

The Freeway control module has a part number 2440, and is used in all Freeway systems, allowing a router system consisting of up to 8 levels to be configured and controlled. The 2440 is fitted as a sub-module onto one of the crosspoint cards, usually the top card, in a Freeway system. Dual control modules may also be fitted, on different crosspoint cards to provide fully redundant operation.

In the lifetime of the 2440 module there has been an important controller software change in order to support the Windows database editor. This change is generally referred to as 'Version 2'. Before Version 2 only the 'DOS' based editor could be used, but Version 2 also changed the function of one of the configuration switches, as detailed later.

The latest hardware change for the 2440 is that the configuration switch has been upgraded from a 'piano' type to a 'slider' type DIL switch, the switch functions remain identical. In order to support the extended Sirius features the controller software has also been upgraded. The first version to support the extended Sirius features is version 2.08.

1.1.2 2441

The 2441 control module was designed for use with Sirius, and although it has the same controller software as the current 2440, it will only physically fit into a Sirius router. This document makes no further reference to a 2441.

1.2 Controller code versions

The following table summarizes all the Freeway control module code versions, with the critical differences between them. If the user is unaware which version they are running, they may safely perform an upgrade to a known version, using the method detailed in the next section and the current editor software.

Freeway Controller Version	To be used with Editor:	Found on module type	RS232 port	Other
V1.XX	DOS editor only	2440 only	Supports General Switcher or General Remote protocol	Switch 2_4 selects RS232 port to Editor or General Remote protocol
V2.03	Freeway Windows editor pre V1.06		Supports General Remote protocol, and Windows editor only. Switchable between 9600 and 38400 BAUD	Switch 2_4 selects RS232 port BAUD rate (all V2.XX)
V2.04	Freeway Windows V1.06 onwards			Also supports analogue video 128x128
V2.05				Also supports Sirius router features
V2.06				
V2.07	Pro-Bel Router Editor	2440 and 2441		Also supports RS422 router in 'broadcast' mode
V2.08				
V2.09				
V2.10				

For operation reasons, some users may have chosen to retain the V1 system, in order that the system may be remotely controlled using the RS232 port configured for General Switcher protocol.

1.3 Re-programming the control module

The 2440 modules are equipped with a 'Flash EPROM' memory, which means that the controller software can be re-programmed using a PC connected to the RS232 port on the Freeway frame. All versions of the Pro-Bel Router Editor are supplied with the necessary tools and instructions for upgrading the code in the users system. If the upgrade is performed, a backup of the original code is retained in order that the user may also perform a downgrade. For completeness, the instructions supplied with the editor are reproduced here:



1.3.1 Upgrade instructions

If the system you are upgrading is fitted with MAIN and BACKUP controllers, one of the 2440s must be removed whilst the other is being updated. Each controller will need to be upgraded separately following the set of instructions below.

WARNING. It will be necessary to take the system off line while performing this upgrade.

If the editable database is being used, this upgrade process will corrupt it.

Before proceeding with the Upgrade it is recommended that you have a backup copy of the current 2440 database. At the end of the upgrade, this can be converted, if necessary, and downloaded to the 2440.

NOTE: DOS databases will need to be converted using the relevant converter program before it can be used with the Windows Editor.

Upgrading the Flash EPROM:

In order to upgrade the software in a 2440/2441 controller, the following set of instructions should be followed:

- 1) Note the current positions of DIL switches 1, 2, 3 and 4 on the 2440 control card and then set switches 1, 2, 3 and 4 to the DOWN(ON) position.
- 2) If the above step has been carried out without removing the switch module housing the 2440, reset the 2440 controller card.
- 3) Connect an RS232 cable from PC COM1 port to RS232 port on the router frame that the 2440 controller(s) are installed in.
- 4) From either a DOS prompt in the Router directory, or from Windows Explorer, run the batch file UPLDOLD. This command will upload three binary image files; MAINOLD.BIN, FIXDBOLD.BIN, and OEMOLD.BIN and save them in the Router directory. These files should not be deleted as they can be used to restore the Router to it's original state should you wish to revert to the original code. If errors are reported, or if any of the three files shown above are not saved in the Router directory, repeat until successful.

NOTE: This process may take a few minutes to complete.

5) Once the above step is complete, run the batch file DNLDNEW. This command performs the upgrade of the controller software by downloading the new binary image files MAIN.BIN, FIXDBE.BIN and OEM.BIN to it.

6) Return the DIL switches 1, 2 and 3 on the 2440 to their state prior to the upgrade. Set DIL switch 4 UP(OFF) if Windows editor port to run at 9600 baud or DOWN(ON) if to run at

38400 baud. Reset the 2440 controller.

7) If a BACKUP 2440 is installed in the system, remove upgraded 2440 and insert BACKUP 2440 and repeat the above steps.

8) If necessary, convert the saved Freeway DOS Editor Database to a Freeway Windows Editor compatible database using the 'Freeway-DOS-to-win32' converter program.

9) If using the editable database, re-download the database to the controller using the appropriate editor.

1.4 Control module functions

The control module is fundamental to the operation of the Freeway routing system. It is a microprocessor-based module with battery backed-up non-volatile memory (NVRAM). The system code is contained in flash memory, allowing rapid boot-up and easy code upgrades. The NVRAM holds a record of the system crosspoint settings (known as the 'tally table'), ensuring that the router status is maintained following power interruptions or signal card removal. It also holds an exact record of the router hardware, known as the 'configuration', which allows the control card to check that all components are present following a reset or power down. Finally, the system database is also held in this memory.

The control module connects to all router crosspoint cards using a parallel control bus, this is used to detect card presence and for setting crosspoints.

All external communication is passed through the control module, whether it is for remote control of the router, or for the connection of control panels and Under Monitor Displays. Finally, the control module detects reference signals, both audio and video, and determines at what point to make a crosspoint switch, in the absence of valid reference signals a 'crash' switch will be implemented.

The Freeway control module is fitted as a sub-board onto one of the crosspoint cards. In a multi-frame system, the control module must be in the frame to which the control panels, or external control system, are connected. The module has configuration switches which determine the operation of the system, details of these switches are given in a later section of this manual. At its upper limit, Freeway may have 8 levels, each varying in size up to a maximum of 128x128. Such a configuration would require multiple Freeway frames, one being designated the 'master', and containing the control module(s), the others being 'slave' frames, with no control module fitted.



1.5 The Freeway database

Freeway is supplied with a built-in control system, meaning that control panels and Under Monitor Displays may be directly connected to the unit. Any router control system requires a 'database' of configuration details, such as the number of logical levels, signal types and control panel functions. For ease of use, such a database is supplied with the unit, known as a 'fixed' database, enabling a basic system to be controlled 'out of the box', either locally or remotely. If the system configuration does not match the 'fixed' database, the user will need to connect a database editor to the unit, using the supplied software and a cable, and edit their own custom database. The editor CD ROM also contains a help file for using the editor.

If the user decides to use a 'configurable' database they should refer to Section 8 of the Freeway user guide, which explains the installation and connection of the Pro-Bel router editor.

1.6 Control Module configuration switches

These switches are basic to the operation of the control system, it is therefore important that reference is made to the following table before the system is used:

1.6.1 2440 fitted with Version 1.XX (DOS editor only)

Switch SW 2	Function	Selection	
		UP	DOWN
1	MASTER/SLAVE SELECT	SLAVE	MASTER
2	μP CLOCK SELECT	10 MHz	20 MHz
3	SYSTEM RUN MODE	NORMAL	TEST
4	RS232 PORT SELECT	EDITOR	REMOTE
5	DEFAULT TRIGGER SELECT	625	525
6	RE-CONFIGURE	MANUAL	AUTO
7	DATABASE TYPE	FIXED	CONFIGURE
8	CONTROL MODE	GENERAL	PANELS

Note: For 2440s fitted with a 'slider' type switch, DOWN is ON

1.6.2 2440 fitted with Version 2.XX (Windows editor)

Switch SW 2	Function	Selection	
		OFF	ON
1	MASTER/SLAVE SELECT	SLAVE	MASTER
2	μP CLOCK SELECT	10 MHz	20 MHz
3	SYSTEM RUN MODE	NORMAL	TEST
4	RS232 PORT BAUD RATE	9600	38400
5	DEFAULT TRIGGER SELECT	625	525
6	RE-CONFIGURE	MANUAL	AUTO
7	DATABASE TYPE	FIXED	CONFIGURE
8	CONTROL MODE	GENERAL	PANELS

Note: For 2440s fitted with a 'piano' type switch, ON is DOWN

1.7 Switch descriptions

The following is a detailed description of the switch setting modes of operation for all control module types. Users must note that there is no 'default' switch setting since there are several distinctly different modes of operation which must be determined by the user:

1.7.1 Master/Slave select

Used in dual control situations, to assign Master/Slave status to the control modules. One module must be set to MASTER and the other to SLAVE so that on reset or power up the Master module powers up first and, hence, always becomes the active controller.

1.7.2 μP Clock Select

Used to select between 10 MHz or 20MHz microprocessor clock frequency, the lower rate is only used for debugging purposes.

1.7.2.1 System Run Mode

Determines which mode of operation the Freeway powers up in (i.e. NORMAL or TEST).



NORMAL is the standard mode of operation. TEST selects a special test mode where various features of the hardware can be tested by Pro-Bel.

1.7.3 RS232 port BAUD rate select

The RS232 port on the rear of the Freeway frame is used by the database editor which runs on a PC using its COM port, or by an external control system using General Remote protocol (SW-P-08). If the Windows based editor is being used it will automatically detect the BAUD rate configured, and therefore this rate only needs changing to 9600 BAUD if the PC being used has difficulty communicating at 38400 BAUD.

1.7.4 RS232 port select

This mode requires selection when pre Version 2 builds of the 2440 control module are in use. 'EDITOR' allows the connection of a DOS based database editor, and 'REMOTE' configures the port to communicate using General Remote or General Switcher Protocol, for connection to an external control system.

1.7.5 Default trigger select

Used to select between a 625 or 525 line reference signal for all source switching when the fixed database is in use. If the reference is not detected by the module, 'crash' switching will occur.

1.7.6 Reconfigure

Selects between AUTOMatic reconfigure of cards in the system on power-up or reset and MANUAL, in which the system configuration is compared to that held in non-volatile memory. It is recommended that during initial configuration the switch be set to AUTO, and when the final desired configuration is achieved, the switch changed to MANUAL. In this way the control module will always look for the intended system card configuration, and if cards or slave systems appear after the initial power-up, they will not be de-configured from the system.

1.7.7 Database Type

Selects whether to use the fixed, non-editable database or the editable one.

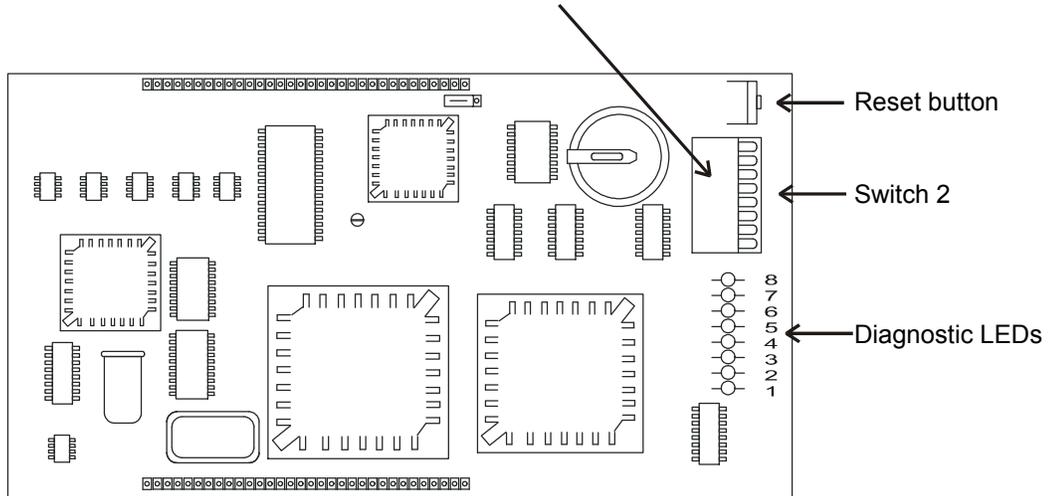
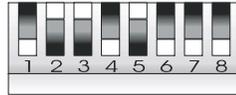
1.7.8 Control mode

Is used in conjunction with the 'database type' switch to select which protocol the serial control ports will use. 'GENERAL' configures both RS485 ports to support General Switcher protocol (SW-P-02) for connection to an external control system. 'PANELS' configures both RS485 Remote ports to support Multi-drop Comms protocol (SW-P-06) for connecting to control panels and under monitor displays.

1.7.9 View of the 2440 fitted with 'piano' type DIL switch

These are normally fitted with pre V2.08 software.

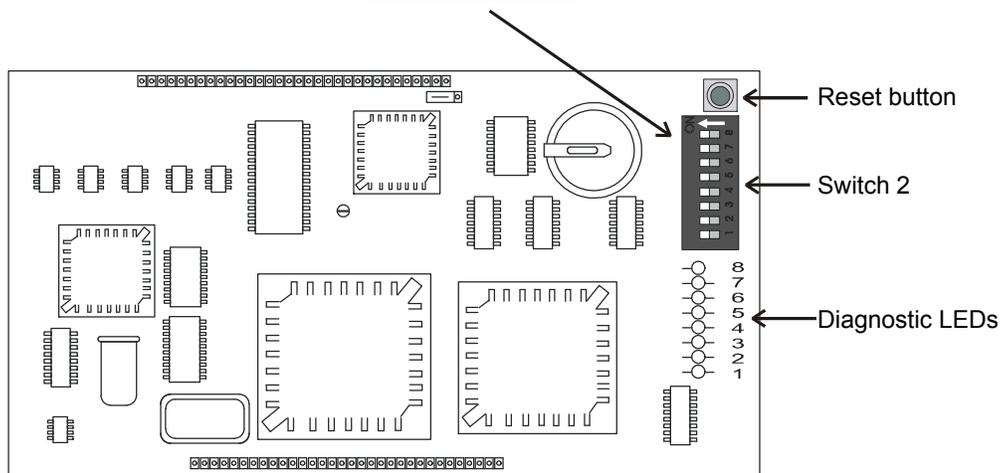
Switch 2 viewed from front
up is OFF
down is ON



1.7.10 View of the 2440 module fitted with a 'slider' type DIL switch

These are normally fitted with V2.08 software onwards.

Switch 2 viewed from top



1.8 2440 Diagnostic LEDS

The 8 yellow diagnostic LEDS on the 2440, all versions, have the following definitions:

LED	Function
1	POWER ON
2	RESET
3	CONTROL CARD ACTIVE
4	Flashing at 2Hz - ACTIVE CONTROLLER Flashing at 1Hz - IDLE CONTROLLER
5	CROSSPOINT SET - FLASHES WHEN SET
6	NO HANDSHAKE FROM A MODULE
7	525 REFERENCE INPUT DETECTED
8	625 REFERENCE INPUT DETECTED
4,8	4 on & 8 flashing: R/W error with RAM
4,7	4 on & 7 flashing: Checksum error in EPROM

1.9 Using the reset button

The 2440 card reset button is not normally accessible in a Freeway system, which is why another reset button is mounted on the front edge of the host crosspoint card, and it is this button that should be used to reset the control module. Resetting the module will cause the processor to re-boot, a process that takes only a few seconds, it will NOT lose the system database or change any crosspoint settings. If switch 2_6 on the 2440 card is set to 'AUTO', a reset will also force the control module to interrogate all the cards in the frame and update it's configuration information. It is therefore important to perform a reset whenever the system size has been increased or decreased, and then set switch 2_6 to MANUAL, to avoid over-writing this configuration should the system be partially powered on a reset.

1.10 Control port details

Freeway has three serial ports available on the rear connector panel as follows:

- 2 x RS485 ports (9 pin D type), common to Master and Slave control cards but only connected to the active controller, configured by the system database
- 1 x RS232 Editor port for configuring the Master control module (9 pin D type) for connecting directly to a PC COM port

When using the Fixed Database (as selected by control module switch 2_7), the RS485 ports must then be configured using control module switch 2_8. See the previous section for these details. When using an editable database, the user must select from one of four protocols for each of these ports, as follows:

- General Switcher Protocol (SW-P-02)
- Multi-drop Communications Protocol (SW-P-06)
- General Remote Control Protocol (SW-P-08), available on RS232 port in V2.XX with fixed database
- Simple Switcher Protocol (SW-P-03), not available with fixed database

1.11 Control protocol descriptions

Pro-Bel General Switcher Protocol (SW-P-02)

Pro-Bel General Switcher Communication Protocol is the preferred method of controlling Pro-Bel routers. It uses numbers in the range 0 to 1023 to set, acknowledge and poll crosspoints via a single 2440 control module. Freeway ports must be configured for this protocol if the router is to be control by an Aurora control system. If the Freeway is a multi-level router, and configured as such in it's database, all levels may be controlled using a destination offset appropriate to its level type in the Freeway database settings. For example:



Aurora

Port to Matrix Assignments

Level 1:

source offset 0

destination offset 0

Level 2:

source offset 0

destination offset 64

Level 3:

source offset 0

destination offset 192

Freeway

Database settings

Level 1: type Freeway 32/64

64 sources

64 destinations

Level 2: type Freeway 128

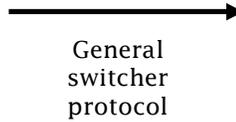
128 sources

128 destinations

Level 3: type Freeway 128

128 sources

128 destinations



In summary, in order for Aurora (or any system using General Switcher protocol) to control a multi-level Freeway, the user must have knowledge of the local database in use, only then can the router control module direct the correct the data to the correct crosspoints.

The normal electrical parameters for this port are:

- RS485 on a 9 pin D type socket configured as 'device'
- 8 bit data
- 1 stop bit
- EVEN parity
- 38.4K baud

Although labeled 'RS485', this port is actually software configured to be point to point, as with RS422, when using this protocol.

The full specification for this protocol is available from Chyron, or on our website (www.chyron.com/support).

Pro-Bel General Remote Control Protocol (SW-P-08)

This protocol has been developed to provide a common method of interfacing Pro-Bel router control systems to a variety of standard and custom applications. An example of the use of this protocol would be the interfacing of the Freeway system to an Aurora Soft Panel control system, or to a TSL Under Monitor Display system. General Remote protocol allows



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the controlling system to access and control all system parameters, using the database configured names, as well as level, source and destination numbers, although not all commands are implemented on the Freeway controller. See SW-P-08 protocol document for full details of commands supported by Freeway.

The full specification for this protocol is available from Chyron.

Pro-Bel Multi-Drop Communications Protocol (SW-P-08)

This protocol is designed to communicate between a Pro-Bel router control system and router control panels and Under Monitor Displays. Up to sixteen 'devices' may be 'daisy-chained' onto one multi-drop control port, each device requires a unique address, identified using an address switch. The control system database must hold configuration data for all devices.

The full specification for this protocol is available from Chyron.

Pro-Bel Simple Switcher Protocol (SW-P-03)

Similar to General Switcher Protocol but with reduced capability, such as only being able to address 128 sources and destinations. It has the advantage of being able to set more crosspoints per video frame than General Switcher. The port may also be configured for baud rates up to 230kbaud.