

IMUX 2000E Index

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Key Features of the IMUX 2000E Intelligent E1 Multiplexer

- **Substation Hardened** — The IMUX 2000E is designed for harsh environments and has a wide temperature range of -20°C to +55°C. It is CE approved and has been tested to BS EN 5502:1995, BS EN 61000-4-2:1995, BS EN 61000-4-3:1997, BS EN 61000-4-4:1995, BS EN 61000-4-6:1996, BS EN 61000-4-8:1994, DD ENV 50204:1996.
- **Speed** — The IMUX 2000E is designed to handle time sensitive applications such as Protective Relaying. The IMUX 2000E “Drop-and-Insert” through delay is less than 25 microseconds. The IMUX 2000E has an average reframe time of less than 5 milliseconds and also has the ability to enable a Fast Reframing Channel (FRC) for less than 1 millisecond reframing.
- **Wide Range of Channel Interfaces** — The IMUX 2000 has the Transfer Trip and Current Differential interfaces required for the Utility marketplace. It also offers a wide range of Voice, and Data, telemetry and video channel interfaces to satisfy most communications requirements.
- **Six-Port Mini-DACS** — The IMUX 2000E can be equipped with a six-port Mini-DACS to provide access to various network topologies. The Mini-DACS has true Time-Slot-Interchange capabilities offering unique features that can be combined in networks for optimal performance.
- **Diverse Networks** — The IMUX 2000E supports many types of network layouts such as “Linear”, “Spurs” and “Ring” topologies. It is also designed for operation over SDH networks taking into consideration the critical time-delay issues associated with Protective Relaying.
- **Fast Restoration** — When applied to diverse communication routes featuring backup paths the IMUX 2000E is capable of switch times programmable down to 1 millisecond.
- **SDH Applications** — Protective Relaying can finally be applied over non-proprietary SDH equipment. With emphasis placed on rapid break healing, the IMUX 2000E addresses the critical time issues associated with Protective Relaying making it the ideal and “Intelligent” choice when interfacing to SDH networks. The IMUX 2000E bridges the gap between SDH and Substations providing DS0 gateways onto the network, and through its own switching techniques, can overcome the longer switch times and unequal channel delay issues associated with SDH.
- **Automation** — The IMUX 2000E offers the ultimate Network Management system which operates in a Windows™ point-and-click environment. Network visibility is available from any node which allows remote provisioning, monitoring and alarm reporting. The IMUX 2000E can also be hardware configured through a front panel user interface on the common logic module.
- **Fiber Optic or Electric E1 Interfaces** — The IMUX 2000E can be equipped with either electric E1 interfaces or Optical Interface Adapters (OIA's). The electrical E1 interface is equipped with Line Build-Out (LBO) networks for operation of up to 1.5km from the DSX using twisted pair cable. The OIA's are available in a wide range of multimode, singlemode, LED or Laser combinations to accommodate 850nm, 1300nm and 1550nm wavelengths.
- **Modular Design** — The IMUX 2000E incorporates a mid-plane motherboard design. Channel modules plug into the front of the unit, and matching Module adapters for I/O connections plug into the rear. This eliminates the need for internal chassis wiring when adding new channel cards, simplifying the upgrade.

IMUX 2000E

The *Intelligent* Multiplexer

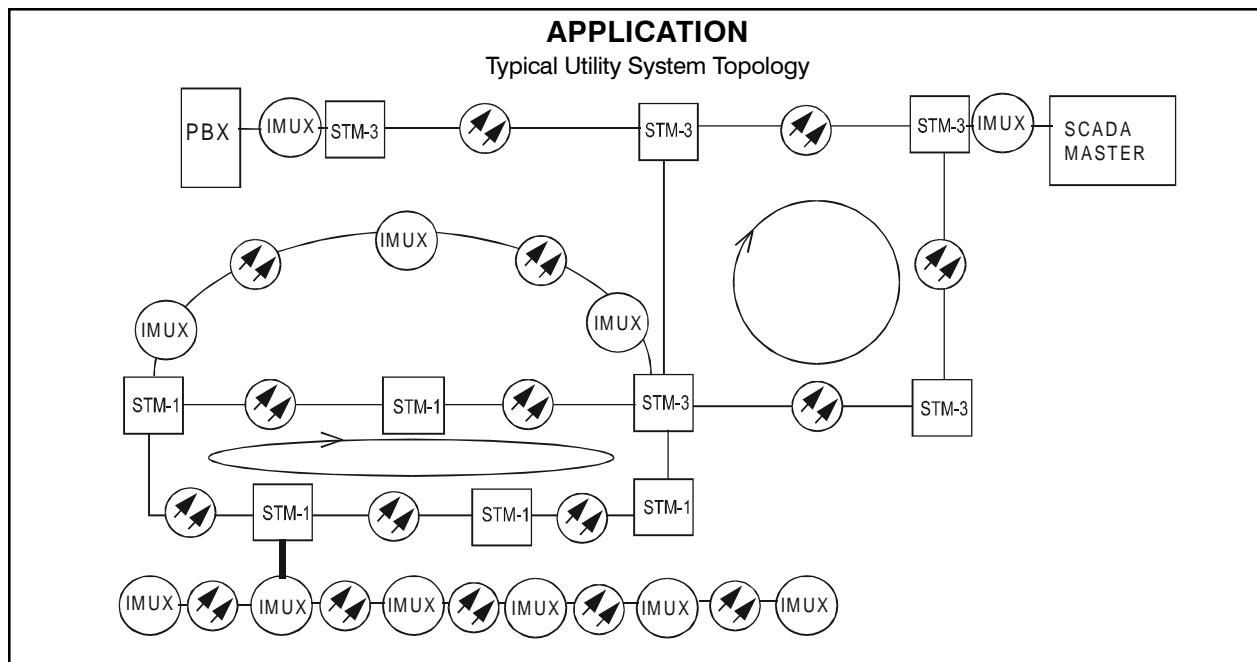
Designed for harsh substation environments, the IMUX 2000E is an E1 digital PCM multiplexer which multiplexes 32 channels into one 2.048 Mbps signal. The unit provides full featured, drop-and-insert capability for each voice frequency circuit or any signal that can be transmitted in a DS0 channel. The drop-and-insert through-channel delay is less than 25 microseconds, including the fiber heads (excluding the communications medium).

The IMUX 2000E is both hardware and software configurable. The IMUX 2000E has an RS-232 port for remote access and control and a local user interface with switches and an alpha numeric display for selecting and setting parameters. The IMUX 2000E offers extensive diagnostics and has bantam test jacks for the E1 input/output signals as well as E1 input/output monitoring.

The multiplexer has electrical and a wide variety of optical fiber (both single-mode and multi-mode) interfaces to simplify system configuration. Channel cards are available for voice, data, telemetry, teleprotection, status and video applications. The RFL Mini-DACS is designed to build networks which automatically recover from data path failures. In applications where recovery time is critical, such as protective relaying, time slot 30 may be used as a fast re-framing channel providing recovery times of one to two milliseconds.

The IMUX 2000E supports all types of network layouts such as "linear", "spurs" and "ring" topologies and has special provisions for operating over non-proprietary SDH networks taking into consideration the critical time delay issues associated with protective relaying. A Windows™ based network management system provides complete network visibility from any single node.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E Features.



IMUX 2000E

Intelligent Multiplexer Standard Specifications

Power Supply:

48/125, 125Vdc and 220 Vac power supplies are available. All shelves can be equipped with a secondary plug-in power supply for redundancy.

<i>Input Voltage</i>	<i>Range</i>
48 - 125 Vdc	38.0 to 150.0 Vdc
220 Vac	180 to 265 Vac

Optical Interface Adapters (OIA):

The IMUX 2000E offers a wide range of fiber optic interfaces for both multimode and single-mode operation. The Optical Interfaces meet the same environmental specifications as the multiplexer itself.

Optical Power Budgets

<i>Emitter</i>	<i>Wavelength</i>	<i>Fiber</i>	<i>System Gain</i>
LED	850 nm	Multimode	25 dB
LED	1300 nm	Multimode	25 dB
LED	1300 nm	Singlemode	18 dB
Laser	1300 nm	Singlemode	36 dB
Laser	1550 nm	Singlemode	30 dB

Alarms and Diagnostics:

Status Monitoring: Constant monitoring of equipment and timing with alarm reporting.

Alarm Types: Alert, cautionary conditions that do not prevent multiplexer operation.

Alarm, conditions that directly affect multiplexer operation.

Interface: Front panel indicators and alpha-numeric display, RS-232 port for remote access and interrogation, shelf alarm and alert Form C relay contacts rated for 100 mA at 250 Vdc

Loopbacks: Line and Equipment

Remote Access and Control:

Functionality: Remote monitoring, configuration and alarm reporting

Interface: RS-232C asynchronous

2 MB Interface:

Interface: Conforms to ITU G.703

Connection Options:

E1 Electrical: 75/120 ohm BNC Connector or DB-15 connector for twisted-pair

Formats:

Frame format per ITU G.704 in 30-channel and 31-channel modes.

Rate:

2.048 mbps, \pm 50 ppm input and output.

Jitter Tolerance and Attenuation:

Tolerance: Exceeds ITU G.823

Attenuation: Greater than 18 dB at 40 Hz, exceeds ITU Requirements.

Line Codes:

HDB3 (High Density Bipolar, Order 3 per ITU G.703, or AMI (Alternate Mark Inversion)

Frame Synchronization:

Average Reframe Time non-signaling DSO's:

0.3 ms with fast reframe

0.6 ms without fast reframe

multi-frame based signals (signaling): 5 ms

User Interface:

Configuration Control:

Switch settings and/or RS-232 asynchronous terminal

IMUX 2000E

Intelligent Multiplexer Standard Specifications

Timing:

Internal: 2.048MHz, ± 30 ppm

Loop: 2.048MHz, ± 50 ppm

External: 2.048 MHz, ± 50 ppm from station clock

Through: 2.048 MHz, ± 50 ppm for drop/insert operation.

Timing Output: 2.048Mbps, G.703 output to synchronize other equipment.

Connector: BNC

Environmental:

Temperature: -20°C to +55°C Operating

Humidity: 95% Non-condensing

CE/EMC Compliance:

BS EN 5502:1995, BS EN 61000-4-2:1995,
BS EN 61000-4-3:1997, BS EN 61000-4-4:1995,
BS EN 61000-4-6:1996, BS EN 61000-4-8:1994,
DD ENV 50204:1996.

Physical:

Dimensions

Height: 134 mm

Width: 483 mm rack mount, per EIA RS-310

Depth: 370 mm

Weight:

6.8 kg typical for fully loaded shelf.

IMUX 2000E Network Management Software

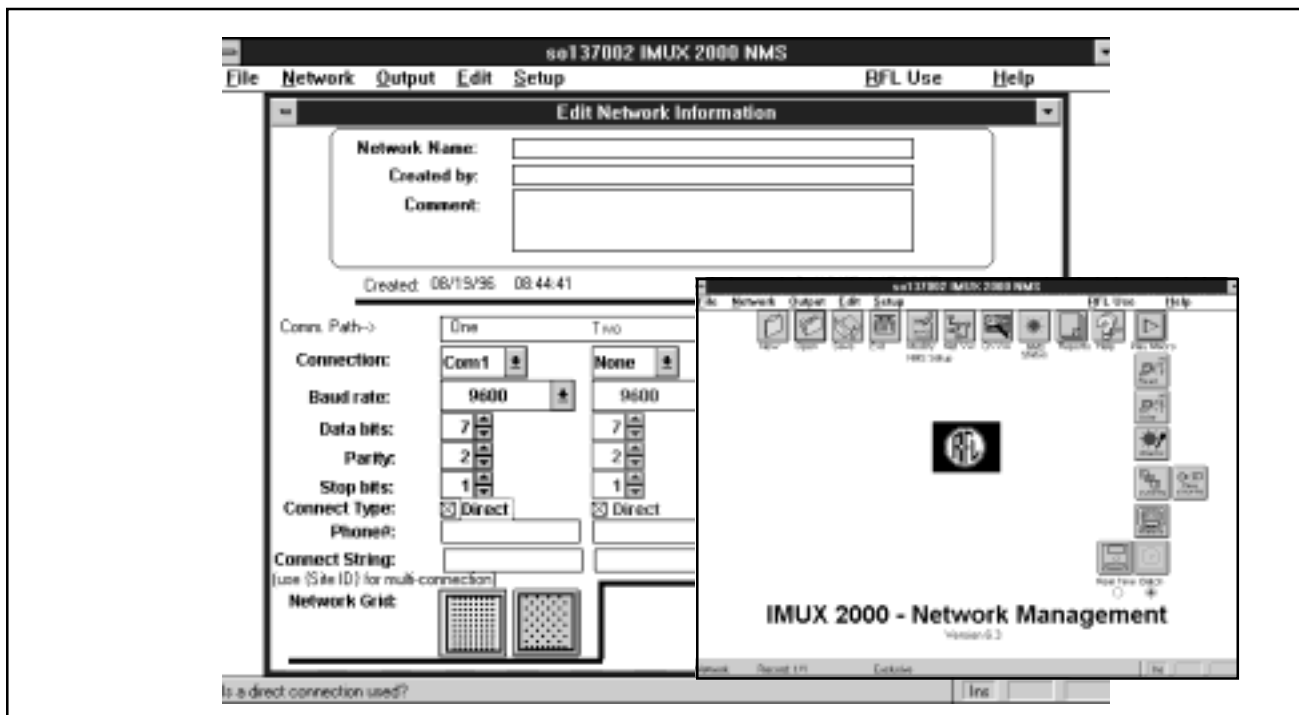
The IMUX 2000E Network Management Software is a tool for Communications Engineers and Technicians who want to get the highest degree of performance and reliability out of their intelligent RFL IMUX 2000E system. This software allows the user to configure and monitor all IMUX 2000E's located in a network and all channel cards that are in each multiplexer. Never before has a powerful, easy-to-use tool been available to the communications or protective relay engineer. This *Intelligent* tool takes the guess-work out of network management and puts the user in total control.

The software is Windows™ based and allows the user to view a graphical picture of their system from any node. If more specific information is required, the user simply selects the network node that he wants and all the information regarding configuring the node (i.e. channel card, time-slot assignments, diagnostic and alarm settings) will appear. The computer is linked to the network using an RS-232 communications link.

All products in the IMUX 2000E family are supported by this software. This includes the *Intelligent Multiplexer*, the individual channel cards, and the *Mini-DACS*.

The Network Management Software can graphically represent linear, loop and spur topologies. A unique feature is the *Intelligence* of the software which enables it to poll all the nodes of a network and display what it sees. This allows the computer to look at the network and graphically represent the present configuration. Additionally, the software can be customized by the user to meet specific requirements.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E Features.



IMUX 2000E

Network Management Software Standard Features

Feature Summary:

Operates under Windows™ (3.1, '95, '98 and NT)
Network Configuration Polling
Pop-up Nodes and Channel Cards
Access to the Mini-DACS.
Auto Configuration Option
Note: Network communications requires dedicating time slot 31 for inter-node communication.

Pull Down Menu Commands:

Network View: Provides the user with a graphical representation of the network being interrogated.

Node View: Allows the user to examine the individual node equipment and make changes where required. A graphical representation of the equipment is shown in which all existing cards are displayed.

View Status: Allows the user access to the state of every alarm point in the node, the status of each channel card and the CM6B.

Card Status: Allows the user to view and change settings on each individual card or module.

Connection View: This simple command provides the user, who is configuring a system, with the information required to easily assign time slots.

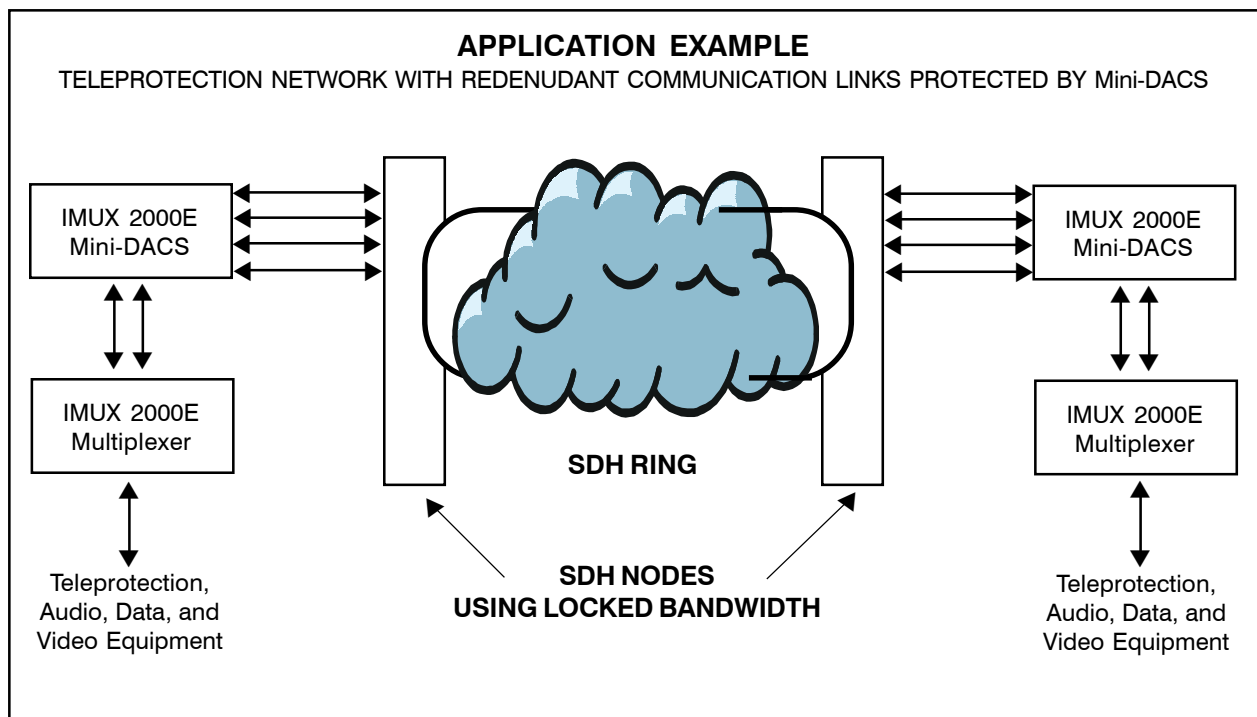
IMUX 2000E Six-Port Mini-DACS

The IMUX 2000E Mini-DACS has six, bi-directional E1 ports with complete DSO Time Slot Interchange (TSI) capability. DSO's are interchangeable and can be placed into any time slot of any E1 port, including looping of individual DSO's or complete E1's. The Mini-DACS allows DSO's from multiple E1 locations to be groomed into common E1 circuits.

The strength of the Mini-DACS lies in its ability to quickly restore communications by utilizing redundant paths. Restoration is accomplished through the use of an alternate DSO-TSI map. This alternate map will need to be pre-determined and pre-programmed by the user. The alternate DSO map will be invoked automatically upon detection of E1 failures (e.g. AIS, Loss of Frame, excessive BER). Map-Switching criteria are selectable and programmable by the user. The time to switch to the alternate map, upon detection of a failure, is programmable down to 1 ms. The Mini-DACS through-delay is two to three E1 frames, averaging 300µs.

The Mini-DACS can be utilized in a wide variety of applications from Linear Systems and Spurs to Loop Topologies, optimizing system performance. The following diagram illustrates an example of applying the Mini-DACS in a ring topology.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E Features.



IMUX 2000E

Mini-DACS Standard Specifications

Power Supply:

48/125Vdc and 220 Vac power supplies are available. All shelves can be equipped with a secondary plug-in power supply for redundancy. The Mini-DACS may be powered from the IMUX 2000E power supply depending on shelf load.

<i>Input Voltage</i>	<i>Range</i>
48-125 Vdc	38.0 to 150.0 Vdc
220 Vac	180.0 to 265.0 Vdc

Optical Interface Adapters (OIA):

The IMUX 2000E Mini-DACS offers a variety of fiber optic interfaces for both multimode and single-mode operation. The Optical Interface meets the same environmental specifications as the multiplexer.

Optical Power Budgets

Emitter	Wavelength	Fiber	System Gain
LED	850 nm	Multimode	25 dB
LED	1300 nm	Multimode	25 dB
LED	1300 nm	Singlemode	18 dB
Laser	1300 nm	Singlemode	36 dB
Laser	1550 nm	Singlemode	30 dB

Alarms and Diagnostics:

Alarm Types: Alert, cautionary conditions that do not prevent Mini-DACS operation. Alarm, conditions that directly affect Mini-DACS operation.

Interface: Front panel indicators and a RS-232 port for remote access and interrogation, shelf alarm and alert from C relay contacts rated for 100mAat250Vdc.

E1 Inputs/Outputs:

Interface: E1 Interface per ITU G.703

Output Rate: 2.048 Mbps \pm 50 PPM, using internal timing

Pulse Amplitude: 2.048 Mbps \pm 50 ppm per ITU G.703

Formats: CCS or CAS per ITU G.704

Line Codes: High Density Bipolar, Order 3 (HDB3). Alternate Mark Inversion (AMI)

Input Impedance: 75/120 ohms resistive (nominal).

Propagation Delay:

E1 Through-Delay: 2 to 3 frames, 300 μ s average.

Remote Access and Control:

Functionality: Remote programming and monitoring.

Interface: RS-232C asynchronous

DS0/E1 Alternate Maps:

Switch Time: Programmable down to 1 ms

Environmental:

Temperature: -20°C to +55°C Operating

Humidity: 95% Non-condensing

CE/EMC Compliance:

BS EN 5502:1995, BS EN 61000-4-2:1995, BS EN 61000-4-3:1997, BS EN 61000-4-4:1995, BS EN 61000-4-6:1996, BS EN 61000-4-8:1994, DD ENV 50204:1996.

IMUX 2000E Six-Port Mini-DACS

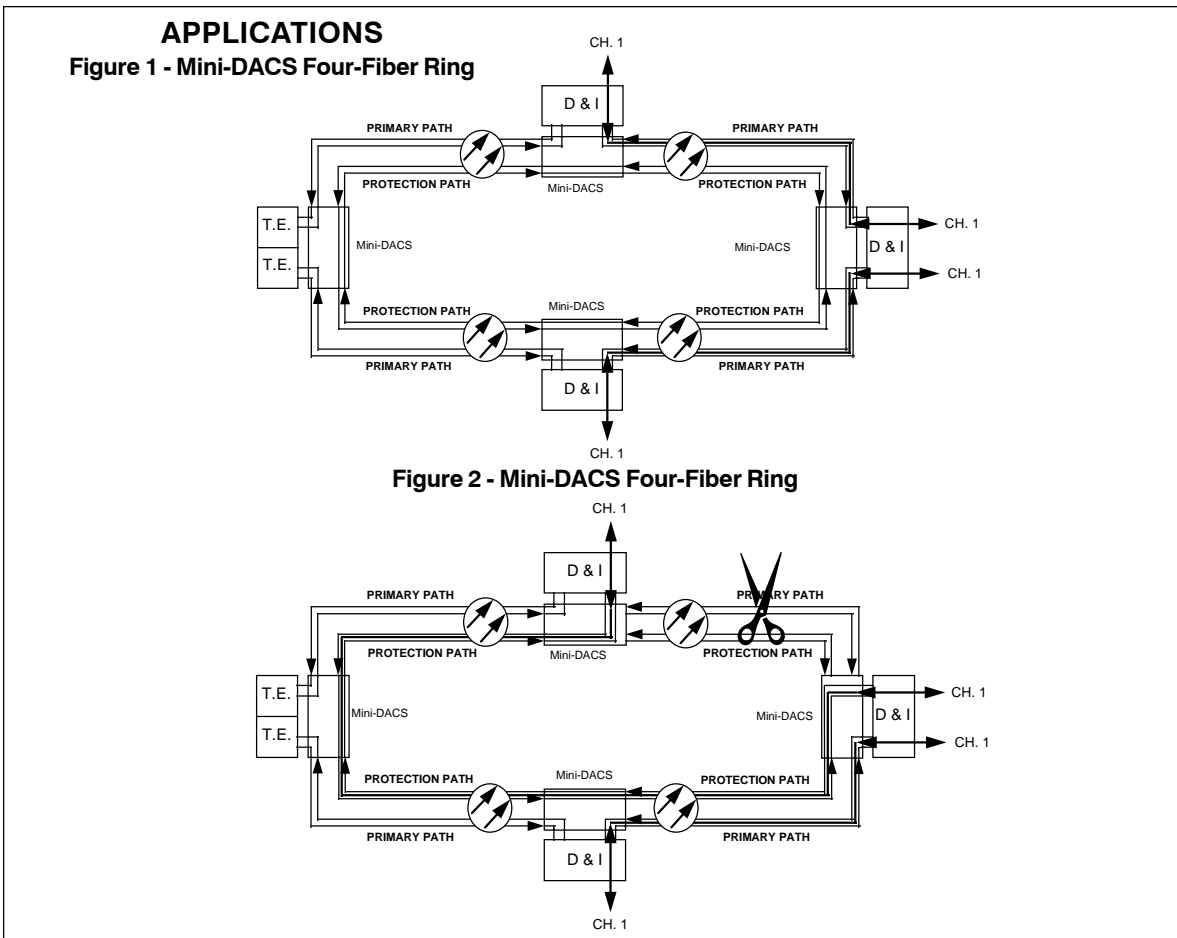
Application Note: Four-Fiber Ring Topology

Four-fiber, self-healing ring operation in the IMUX 2000E is accomplished using RFL's Mini-DACS. Four E1's are brought into each location from adjacent nodes (two from each) to form a ring (Figure 1). Two terminal end-units are *head-and-tailed* at a central location using a common Mini-DACS. All other units around the ring are drop-and-insert units also utilizing a Mini-DACS.

Each of the 31 channels within the E1's data stream may be reused within the loop for maximum bandwidth utilization. Under normal operation each channel is mapped between nodes through the Mini-DACS using a *primary* E1 path. An alternate or *protection* E1 path is circulating around the ring with no data on it. The Mini-DACS monitors its active connections. In the event a failure is detected, the Mini-DACS nodes connected to the faulty line will re-direct the affected E1 traffic in the opposite direction around the ring on the *protection path* (Figure 2).

Upon restoration of the failure, traffic is automatically re-routed back to its normal (*primary*) communications path. In the event of a node failure, the IMUX 2000E has safeguards to prevent against DS0 misconnections. This type of ring topology will guard against single point path failures with the understanding that all channels can be healed except those at a failed node.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



VF-5AE

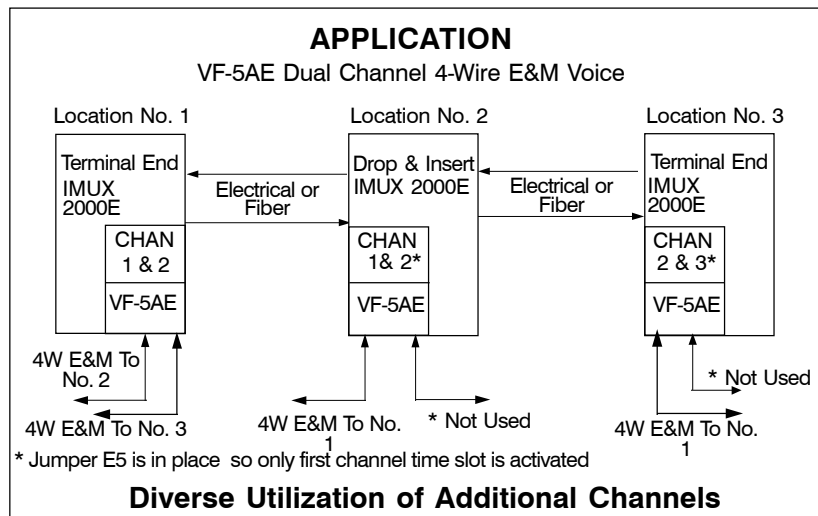
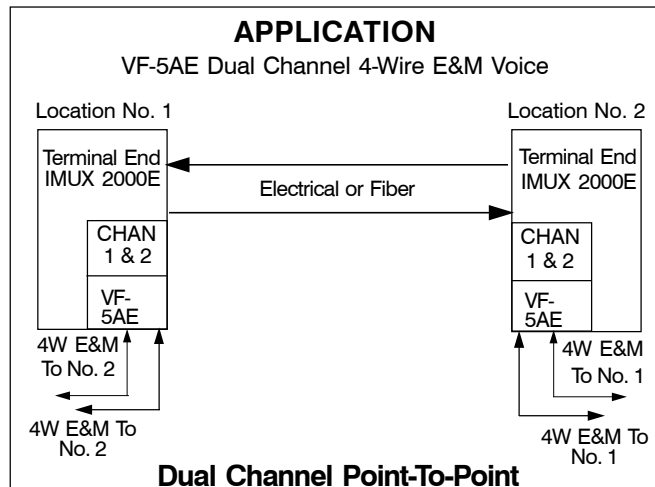
Dual-Channel PCM 4-Wire E&M Voice Frequency Module

The VF-5AE is a 4-wire E&M voice frequency module designed for use in the IMUX 2000E Multiplexer. Each module accommodates two voice channels, providing high quality voice characteristics and extended range input/output level adjustments.

The VF-5AE uses PCM coding with each voice channel occupying one 64 kbps time slot.

Switches on the module allow the user to select E&M Type I, II, or III signaling, with front panel status indicators. Front panel bantam jacks provide test access. The VF-5AE requires the use of the MA-301 or MA-301A Module Adapter for voice interface.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



VF-5AE

Standard Specifications

Configuration:

Two independent voice channels per card

Time Slots:

One channel operation uses a selectable 64 kbps time slot. Two channel operation uses any two adjacent 64 kbps time slots.

Frequency Response:

300 to 3000 Hz, ± 0.3 dB

3000 to 3400 Hz, $+ 0.15/-3.0$ dB

Input/Output Level:

Nominal -16 dBm input, +7 dBm output

Input Level Range:

Adjustable in 0.1 dB steps

-19.0 dBm to +5.0 dBm

Output Level Range:

Adjustable in 0.1 dB steps

-14.0 dBm to +10.0 dBm

Impedance:

600 ohms input/output

Idle Channel Noise:

Not to exceed -65 dBmOp

Signal To Distortion:

1004 Hz input, 0 to -30 dBm

Greater than 33 dB, C message

Signaling Format:

CAS (Channel Associated Signaling)

or no signaling

M-Lead Input:

Input impedance greater than 20K ohms to ground

Busy: -20 to -60 volts

Idle: Open or ground

E-Lead Output:

Busy: Less than 50 ohms to ground

Idle: Open

Connector:

The VF-5AE requires the use of an MA-301 or MA0301A Module Adapter. The MA-301 provides a 50-pin TELCO female connector for voice interface. One MA-301 can accommodate up to three VF-5AE modules (six voice channels) in adjacent physical slots.

The VF-5AE may also use the MA-301A module adapter for Transmission Only (TO) application. This module accommodates a single VF-5AE and requires two physical slots. The electrical connections are made via terminal blocks. This module adds SWC capability to the connections. Only the 4-wire transmit and receive connections are terminated on the MA-301A.

Temperature:

-20°C to +55°C operating

Humidity:

95% Non-condensing

Power Consumption:

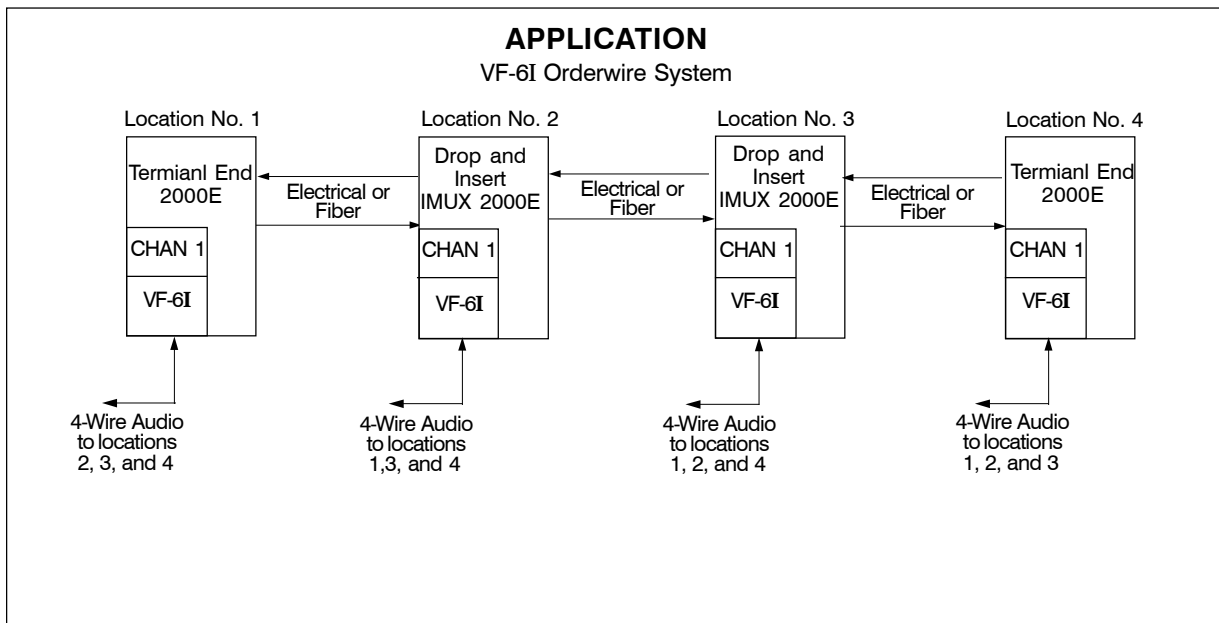
1.0 watt nominal

VF-6I

Single-Channel Four-Wire Order Wire Module

The RFL VF-6I Orderwire Module provides a multi-drop (party line) communications link between facilities using a single time slot. The module may be used in terminal and drop/insert T1 or E1 multiplexers. The unit uses μ -Law companding and may be configured to transmit in either or both bus directions. The signaling is either CAS (in E1) or RBS (in T1), or the signaling may be disabled.

The VF-6I is compatible with most four-wire devices. It may be configured for E&M Type I, II, or III signaling, or a proprietary (VF-6 compatible) format. The unit may be configured in four transmit modes: continuous transmit, hook-switch activated, voice activate (VOX), or receive only. The calibrated extended-range audio input and output level adjustments make it easy to integrate into a system.



VF-6I

Standard Specifications

Configuration:

One voice channel pin card.

Input Level:

-19.0 dBm to +5.0 dBm nominal (-16 dBm typical), adjustable in 0.1 dB steps.

Output Level:

-14.0 dBm to +10.0 dBm nominal (+7 dBm typical), adjustable in 0.1 dB steps.

Input Impedance: 600 ohms

Output Impedance: 600 ohms

Frequency Response:

300 to 3000 Hz (± 0.3 dB)

Idle Channel Noise: Less than 23 dBm_{c0}

Signal-to-Noise: Greater than 38 dB

Signaling input:

M-Lead (Type I, II, or III), hook-switch, or a proprietary active low input

Signaling method:

CAS (E1), RBS (T1), or no signaling

Environmental:

-20°C to +55°C. 0 to 90% relative humidity, non-condensing.

Interface:

50-pin connector on the MA-301 Module Adapter or terminal block connections on the MA-301A-1 Module Adapter. The MA-301A-1 provides SWC protection to the signal lines.

Power Requirements: 1W typical

VF-15C

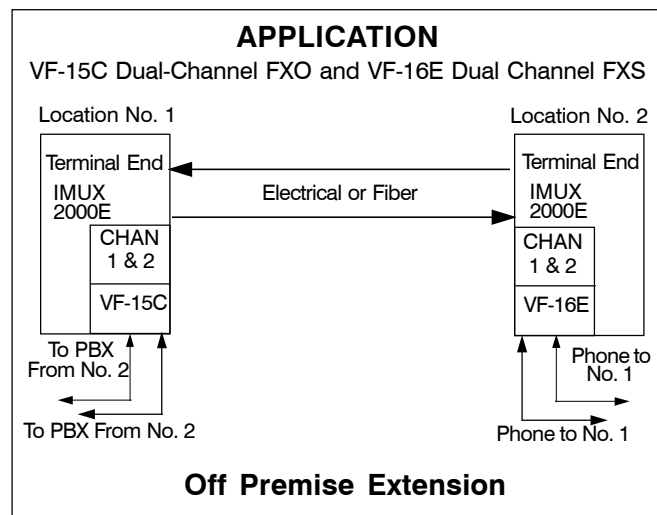
Dual-Channel 2-Wire Foreign Exchange Office End (FXO) Module

The VF-15C is a voice frequency module which is used to connect a standard 2-wire telephone line from a central office or PBX to the IMUX-2000 T1 or E1 Multiplexer. The module may be used in conjunction with the RFL VF-16 (FXS) Module to provide an off premise extension. The module may be configured to use one or both of the available channels, each enabled channel utilizes one 64 Kbps time slot.

The module automatically configures itself for T1 or E1 operation. In a T1 system the coding is μ -Law and the signaling is robbed-bit. In E1 the coding is A-Law and the signaling is CAS. The two channels are independently selectable for loop start or ground start operation.

The module can use either an MA-303 or MA-301 Module adapter. The MA-303 provides two RJ-11 jacks (with input protection circuits and bantam jacks for testing). The MA-301 provides a single 50-pin connector for terminating up to three voice modules (six channels) with a single connection.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E products.



VF-15C

Standard Specifications

Configuration:

Two independent voice channels per card

Time Slots:

One channel operation uses selectable 64 kbps time slot. Two channel operation uses any two adjacent 64 kbps time slots

Signal Levels:

Input: -26 to 0 dBm *Output:* -26 to + 0 dBm

Frequency Response:

200-300 Hz, +0.5 to -2.0 dB
300-3000 Hz, +0.5 to -0.5 dB
3000-3300 Hz, +0.5 to -1.0 dB

Idle Channel Noise: Less than 23dBmCO

Impulse Noise:

Threshold Level Maximum Counts Per 30 Minute Interval:

38 dBmC: 10.0 Counts
44 dBmC: 1.0 Counts
50 dBmC: 0.1 Counts
Phase Hits+10° 0 Counts
Gain Hits +3 dB: 0 Counts
Drop Outs -12 dB 0 Counts

Signal-To-Noise Ratio: Greater than 33 dB

Peak-To-Average Ratio (PAR): Greater than 94

Ringling Voltage: Threshold 30Vrms, 20/30Hz

Signaling Format:

T1 systems: RBS (Robbed-Bit Signaling)
E1 systems: CAS (Channel-Associated Signaling)

Network Interface:

Loop-Start:

Leakage current (Tip-Ring, On-Hook) Less than 10 μ A @ -50V.

Loop current (Off-Hook): 15 to 80mA.

Ground Start:

Ring Conductor Status:

Idle: Greater than 50K ohms to ground.

Line Seizure: Less than 850 ohms to ground.

Tip Conductor Detect:

Idle: Greater than 20K ohms to ground.

Line Seizure: Less than 2400 ohms to ground.

Tracking:

<i>Input 1004 Hz</i>	<i>Deviation From Gain</i>
0 to -40 dBmO	0.5 dB maximum
-40 to -50 dBmO	1.0 dB maximum

Interface:

RJ-11 jacks on MA-303 module adapter or 50 pin connector on MA-301 Module Adapter.

Power Dissipation:

1.6W Typical

Temperature

-20°C to +55° C Operating

Humidity:

95% Non-condensing

VF-16E

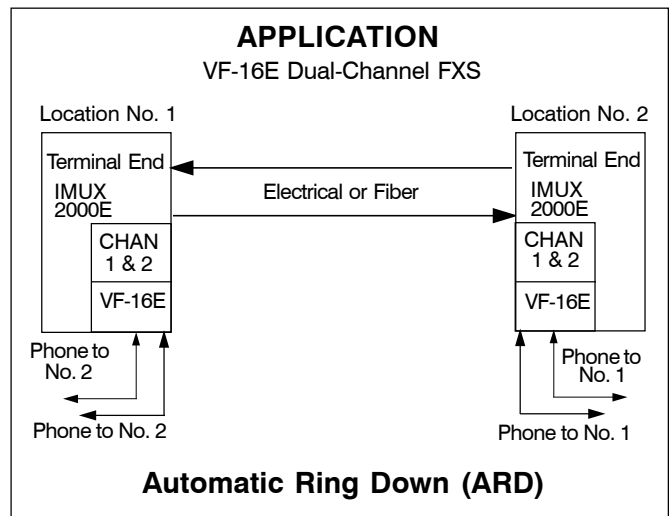
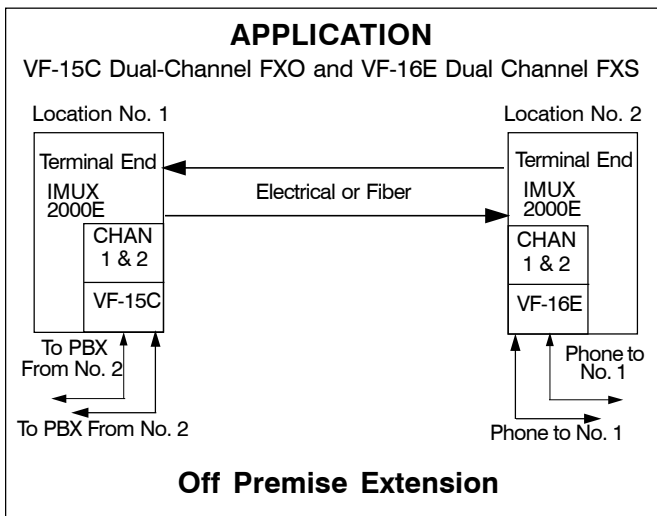
Dual-Channel 2-Wire Foreign Exchange Station End (FXS) Module

The VF-16E is a voice frequency module which is used to connect a standard 2-wire telephone to the IMUX-2000E E1 Multiplexer. The module may be used in conjunction with the RFL VF-15C (FXO) Module to provide an off premise extension. Two VF-16E's may be used with Automatic Ring Down (ARD) to provide a direct node-to-node telephone link without requiring a PBX or Key system.

The module may be configured to use one or both of the available channels, each enabled channel utilizes one 64 Kbps time slot. The coding is A-Law and the signaling is CAS.

The module can use either an MA-303, MA-304, or MA-301 Module adapter. The MA-303 provides two RJ-11 jacks (with input protection circuits and bantam jacks for testing). The MA-303 requires an external ring generator be used to supply the ring voltage. The MA-304 is the same as the MA-303 but includes a ring generator. The MA-301 provides a single 50-pin connector for terminating up to three voice modules (six channels) with a single connection.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E products.



VF-16E

Standard Specifications

Configuration:

Two independent voice channels per card

Time Slots:

One channel operation uses selectable 64 kbps time slot. Two channel operation uses any two adjacent 64 kbps time slots

Signal Levels:

Input: -9.0 to +9.0 dBm *Output:* -9.0 to +9.0 dBm

Frequency Response:

200-300 Hz, +0.0 to -3.0 dB
 300-3000 Hz, +0.5 to -1.0 dB
 3000-3300 Hz, +0.0 to - 1.5 dB

Idle Channel Noise: Less than 23dBmco

Impulse Noise:

Threshold Level Maximum Counts Per 30 Minute Interval:

41 dBmco	10.0 counts
51 dBmco	1.0 count
58 dBmco	0.1 counts

Signal-To-Noise:

Input 1004 Hz to 1020 Hz Overall Distortion C- Message:

0 to -30 dBmO	Greater than 33 dB
-40 dBmO	Greater than 27 dB
-45 dBmO	Greater than 22 dB

Impedance: Switchable 600 or 900 ohms

Crosstalk Coupling:

<i>Frequency</i>	<i>Crosstalk</i>
400 Hz	49 dB
700-1100 Hz	59 dB
1100-3000 Hz	58 dB
3700 Hz	49 dB

Peak-To-Average Ratio (PAR): Greater than 94

Ring Voltage: 50 to 120 Vrms, 20/30 Hz

Signaling:

	<i>Detection/</i>	<i>External</i>
	<i>Transmission</i>	<i>Resistance</i>
<i>Loop-Start:</i>	Off-Hook	2000 ohms or less
	On-Hook	10K ohms or more
<i>Ground-Start:</i>	Ring-ground	1500 ohms connected to -5V or less

Automatic Ring Down (ARD):

Requires VF-16 FXS modules on each end of circuit
 Ring 2 seconds on, 4 seconds off, Ring back tone 300 Hz

Tracking:

<i>Input 1004 Hz</i>	<i>Deviation From Gain</i>
+3 to -37 dBmO	0.5 dB maximum
-37 to -50 dBmO	1.0 dB maximum

Interface:

RJ-11 jacks on MA-303/MA-304 module adapter for voice interface or 50 pin connector on MA-301 module adapter.

Testing:

Line & Drop Bantam Jacks on MA-303/MA-304 module adapter

Power Dissipation:

Off-Hook: 1.2W from shelf power supply, plus 1W from -48 Vdc talk current supply
On-Hook: 1.2W from shelf power supply

Temperature:

-20°C to +55° C Operating

Humidity:

95% Non-condensing

VF-25E

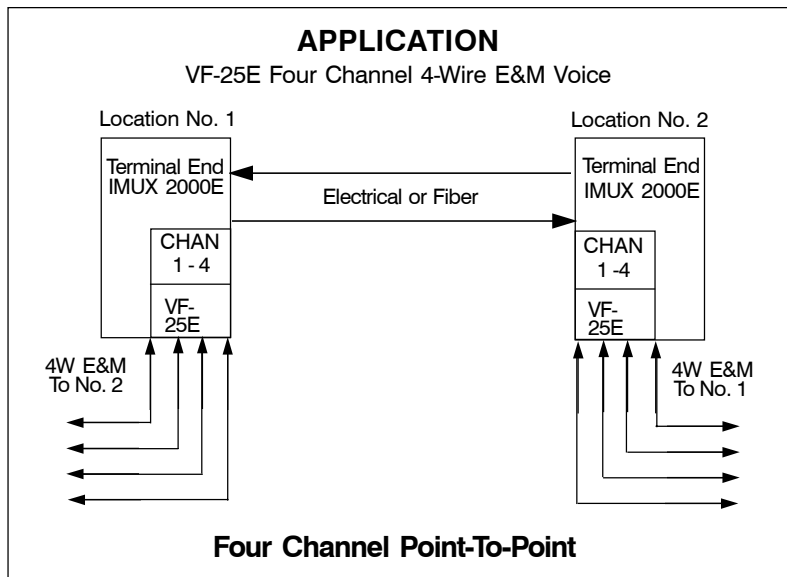
Four-Channel PCM 4-Wire E&M Voice Frequency Module

The VF-25E is a 4-wire E&M voice frequency module designed for use in the IMUX 2000E. Each module accommodates four voice channels, providing high quality voice characteristics and extended range input/output level adjustments.

The VF-25E uses PCM coding with each voice channel occupying one 64 kbps time slot.

The VF-25E supports E&M signaling types I, II, III and V, and can also operate in Transmission Only (TO) mode with signaling turned off. The E&M signaling type is selected by settings on the module adapter. The VF-25E requires the use of a MA-305 module adapter for voice.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



VF-25E

Standard Specifications

Configuration:

Four independent voice channels per card

Analog**Frequency Response:**

300 to 3000 Hz, ± 0.5 dB

Input/Output Level (Nominal):

0 dBm in, 0 dBm out

selectable -16 dBm in, +7 dBm out

Impedance:

600 ohms input/output, balanced

Idle Channel Noise:

Less than 23 dBmC

Signal To Distortion:

1004 Hz input, 0 to -30 dBm

Less than 33 dB, C message weighing

Signaling:

CAS (Channel Associated Signaling)

Signaling Type (Selectable):

CAS with E & M type I, II, III, or V, or
Transmission only (TO) operation.

M-Lead Input:

Type I, II and III:

Busy=-20 to-60 volts

Idle=Open

Type V:

Busy=Ground

Idle=Open

E-Lead Output:

Type I, II, and V:

Busy=Ground

Idle=Open

Type II:

Busy=Contact closure to SG

Idle=Open

Digital Coding and Data Rate:

A-law PCM, 64 kbps per channel

Time Slots:

One to four sequential time slots (one per active channel). Starting time slot selectable.

Status and Diagnostics Loopbacks:

Local and remote analog loopbacks, activated via the multiplexer's remote access port

LED Indicator

Green LED for Service On

Physical and Environmental Connector:

50-pin telco-type female connector on MA-305 Module Adapter

Temperature:

-20°C to +55°C

Humidity:

95% Non-condensing

DA-91E

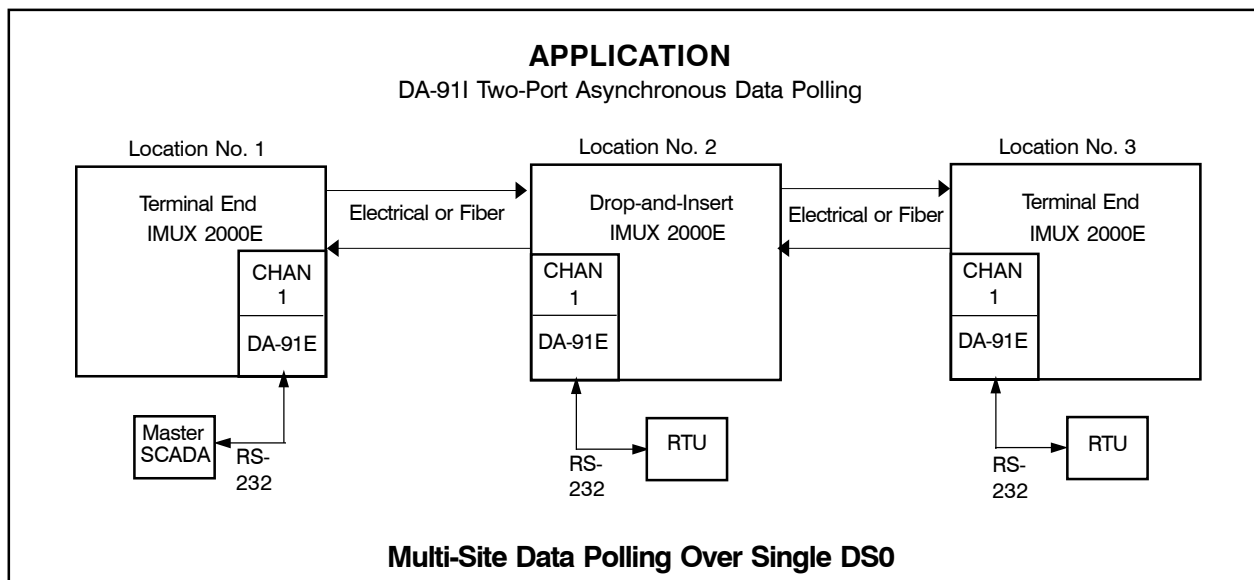
Two-Port Asynchronous Data Polling Module

The DA-91E is an asynchronous data module designed for use in the IMUX 2000E. It provides one or two full duplex channels between an unlimited number of locations using only one 64 kbps time slot.

The DA-91E is ideal for interconnecting remotely located DTE equipment that can respond to data polling. It constantly monitors data from one or both directions of an E1 line in drop and insert applications, or from one direction in a Terminal End Multiplexer.

Transmission is activated on receipt of an RTS (Ready-To-Send) signal from the DTE equipment. The transmission rate for single channel operation is up to 9.6 kbps; for dual channel operation, up to 4.8 kbps for each channel. Connection is through plug-in module adapter MA-402.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



DA-91E

Standard Specifications

Asynchronous Data Interface:

Full duplex, DCE, one or two channel operation, two independent RS-232 data ports

Signals Supported:

Local DTE to DCE Signals:

Ready to Send (RTS),
Clear to Send (CTS) strapped to RTS,
Data Set Ready (DSR) strapped on

End-to-End Signals:

TX Data, RX Data
Receive Line Signal Detect (RLSD) active at detection of RTS from a remote site

Jitter:

At maximum input rate (9.6 kbps single channel, 4.8 kbps dual channel), worst case output jitter is 30% (proportionally lower for lower input rates)

Time Slot:

Both single and dual channel operation occupy a single selectable 64 kbps time slot.

RS-232 Interface:

Supports TX Data, RX Data, Receive line Signal Detect (RLSD), Request-to-Send (RTS), Clear-to-Send (CTS), Data-Set-Ready (DSR), Ground

Connector:

The DA-91E requires the use of an MA-402 Module Adapter, which provides two DB-9 connectors for the RS-232 interfaces

Temperature:

-20°C to +55°C Operating

Humidity:

95% Non-condensing

Power Consumption:

1.25 watts nominal

DA-191A

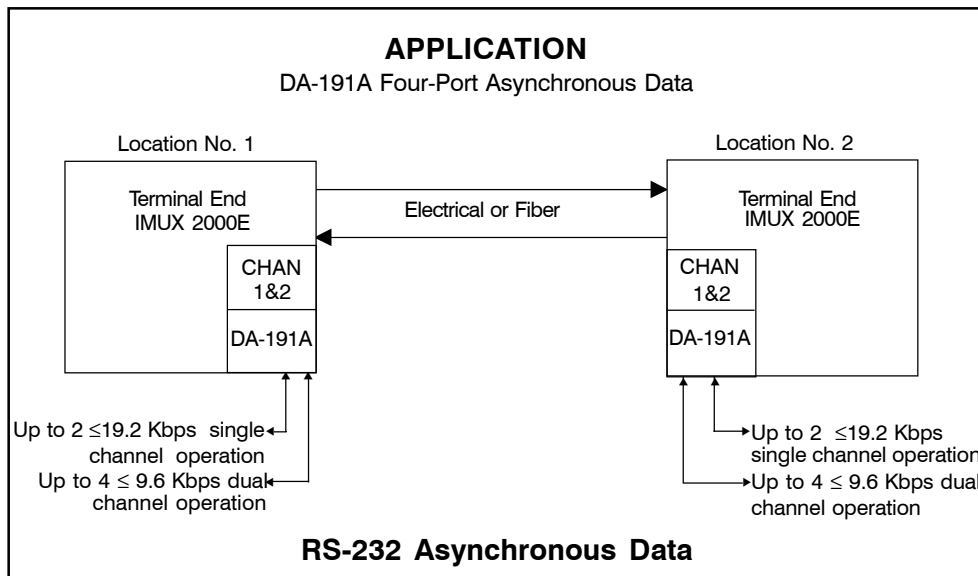
Four-Port Asynchronous Data Module

The DA-191A is an asynchronous data module designed for use in the IMUX 2000E. It provides an interface for up to four independent channels and can operate in half or full duplex modes. The module uses one or two time slots depending upon configuration.

Data rates up to 19.2 Kbps are supported for one or two channel operation. Data rates up to 9.6 Kbps are supported when configured for four channel operation.

The DA-191A requires the use of an MA-420 (two-port) or MA-440 (four-port) Module Adapter which provides the RS-232 interfaces via DB9 connectors.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



DA-191A

Standard Specifications

Asynchronous Data Interface:

One way or full duplex, one to four channel operation, four independent RS-232 data ports

Data Rates:

One or two channel operation:

0 bps to 19.2 kbps each channel

Four channel operation:

0 bps to 9.6 kbps each channel

Jitter:

Dependent on maximum data rate selected

19.2 kbps = 8 μ sp-p

9.6 kbps = 16 μ sp-p

4.8 kbps = 32 μ sp-p

Time Slot:

Depending on data rates, any one time slot or any two adjacent time slots. Reference chart below.

RS-232 Interface (MA 420, MA 440):

Supports TX Data, RX Data, Clear-to-Send (CTS), Carrier Detect

Connector:

Female DB9 (2 on MA 420, 4 on MA 440)

Temperature:

-20°C to +55°C Operating

Humidity:

95% Non-condensing

Power Consumption:

1.2 watts nominal

Data Rate and Time Slot Usage		
Maximum Data Rate	Active Ports	Time Slots Required
19.2 kbps	1	1
19.2 kbps	1 and 2	2
9.6 kbps	1 and 2	1
9.6 kbps	1 to 4	2
4.8 kbps	1 to 4	1

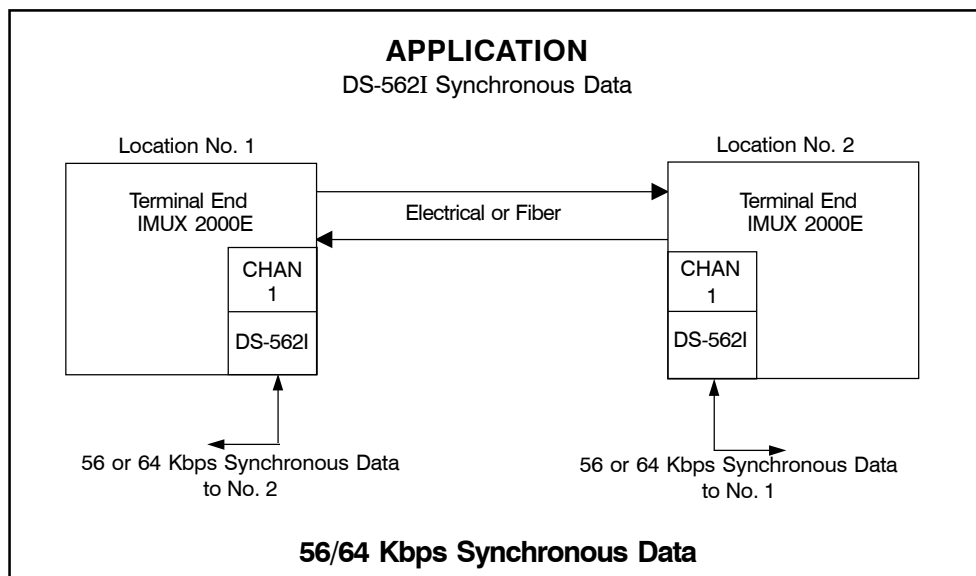
DS-562I

Synchronous Data Module

The DS-562I Synchronous Data Module provides a full-duplex synchronous data communication circuit capable of operating at selectable speeds of 56 kbps or 64 kbps. The DS-562I can be equipped with RS-449, V.35, G.703 Co-Directional/Contra-Directional and X.21 electrical interfaces through plug-in module adapters MA-406IA: RS-449, MA-407I: G.703 Contra-Directional, MA-408I: G.703 Co-Directional, MA-409I: V.35 and MA-410I: X.21 respectively. A short haul fiber optic Module Adapter is also available for the DS-562I. This adapter provides a high degree of isolation and allows equipment to be located further away from the multiplexer. This adds exceptional flexibility when configuring systems for use in noisy or otherwise hostile environments. The short haul fiber interface may be directly connected to the RFL 9300, 9745, or converted to an RS-449 interface for connection to other equipment.

The DS-562I front panel has data activity status indicators for monitoring and trouble shooting. The DS-562I loopbacks can be accessed remotely using the RS-449 interface. When set for 56Kbps, the DS-562I supports addressing which ensures that the data is only received at the proper node.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



DS-562I

Standard Specifications

Clock/Data Rate:

Selectable, 56 or 64 Kbps

Time Slots:

One selectable time slot

Impedance Differential:

<i>Output:</i>	0 ohms	RS-449
	100 ohms	ITU V.35
	300 ohms	G.703
	100 ohms	X.21

<i>Input:</i>	600 ohms	RS-449
	100 ohms	ITU V.35
	120 ohms	G.703
	100 ohms	X.21

Voltage Range Differential:

<i>Output:</i>	2.0-4.0 volts	RS-449 & X.21
	0.44-0.66 volts	ITU V.35
	0.95-1.05 volts	G.703

<i>Input:</i>	0.2-6 volts	RS-449
	0.2-6 volts	ITU V.35
	0.35-1.0 volts	G.703
	0.3-6.0 volts	X.21

Distortion Tolerance:

Send Timing Jitter: $\pm 1\%$

Receive Timing Jitter: $\pm 2\%$

Send Data: $\pm 25\%$ of sampling interval

Receive Data: $\pm 25\%$ of sampling interval

External Cabling Recommendations:

Maximum Length:

RS-449, V.35: 60m

G.703: 250m

Cable type: Shielded twisted, AWG 24 (minimum)

Connector:

RS-449 Interface: 37-pin male

D-subminiature (DC-37P) ITU V.35 Interface: 37-pin

male D-subminiature (DC-37P) *ITU G.703 Interface:*

25-pin male D-subminiature (DC-25P)

Handshaking Delay:

Switched: 8 microseconds (approx.)

Unswitched: Zero delay

Local Loopback (switched):

Equivalent to ITU V.54 Loop 3.

Temperature:

-20°C to 55°C Operating

Humidity:

95% Non-condensing

Power Consumption:

2 watts maximum

Short Haul Fiber Interface:

Directly connects to RFL 9300, 9745 or

RS-449 converter.

DS-64NC

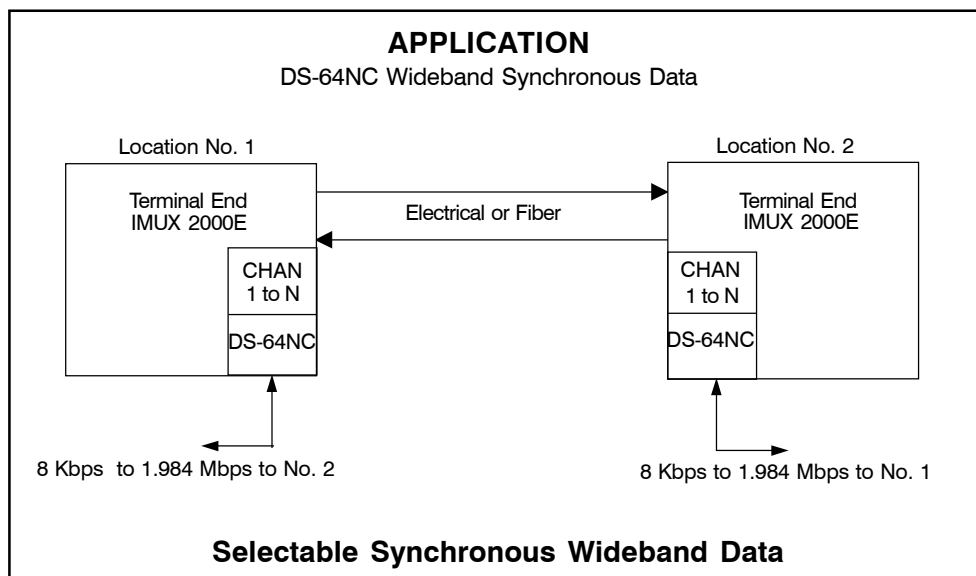
Wideband Synchronous Data Module

The DS-64NC is a wideband synchronous data module designed for use in the IMUX 2000E. The module can operate at a user-selectable data rate from 8 kbps to 1.984 Mbps.

Features include fully independent send and receive timing (at the same nominal rate in both directions), half or full duplex operation, local and remote loopbacks and a test pattern generator and error detector for one-way or loopback testing.

Easy-to-use, plug-in Module Adapters provide the channel interface, RS-449 or V. 35, in either DCE or DTE configurations. Connections are through plug-in module adapters MA-412, MA-413, MA-414, or MA-415 respectively.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



DS-64NC

Standard Specifications

Data Rates:

8 Kbps to 1.984 Mbps in 8 kbps increments

Data Format:

No restrictions on data content

Data Interface:

Configurable for RS-449 or V.35, DCE or DTE by selection of appropriate Module Adapter.

MA-412 (RS-449, DCE), MA-413 (V.35, DCE), MA-414 (RS-449, DTE) & MA-415, (V.35, DTE)

Signals Supported:

RS-449: SD, TT, ST, RS, CS, RD, RT, RR, DM, TM, and SG.

ITU V.35: SD, SCT, SCTE, RD, RTS, SCR, CTS, DSR, RLSD, LT, AND SG.

Timing:

DTE: Synchronizes network to receive timing input. Provides terminal timing output synchronized to network.

DCE: Provides send and receive timing synchronized to the network. Can synchronize network to terminal timing.

Transmit and Receive Buffers:

12 Kbyte deep buffers, with user-selectable starting depth; either 256 bits for synchronous operation, or 6000 bits to support plesiochronous operation.

Time Slot Selection:

Selectable use of adjacent or alternate time slots.

DS0 Usage:

56 or 64 kbps per time slot, with unused bits set to logic "1"

LED Indicators:

Service On/Off, Transmit Activity, Receive Activity, Loopback Active, Buffer Over or Underflow, Receive bit errors (compares bits from test pattern generator and bits known to be set to logic "1")

Loopbacks:

Local and far-end loopback capability

Test Patterns:

Generates and detects test patterns for one-way or loopback testing. Patterns are all 'ones', a single one with fifteen zeros, and $2^{15} - 1$ quasirandom sequence. Error light flashes when bit errors detected

Operating Modes:

Transmit-only, receive-only, or full duplex

Temperature:

-20°C to +55° C Operating

Humidity:

95% Non-condensing

Power Consumption:

2.5 watts nominal

MTS

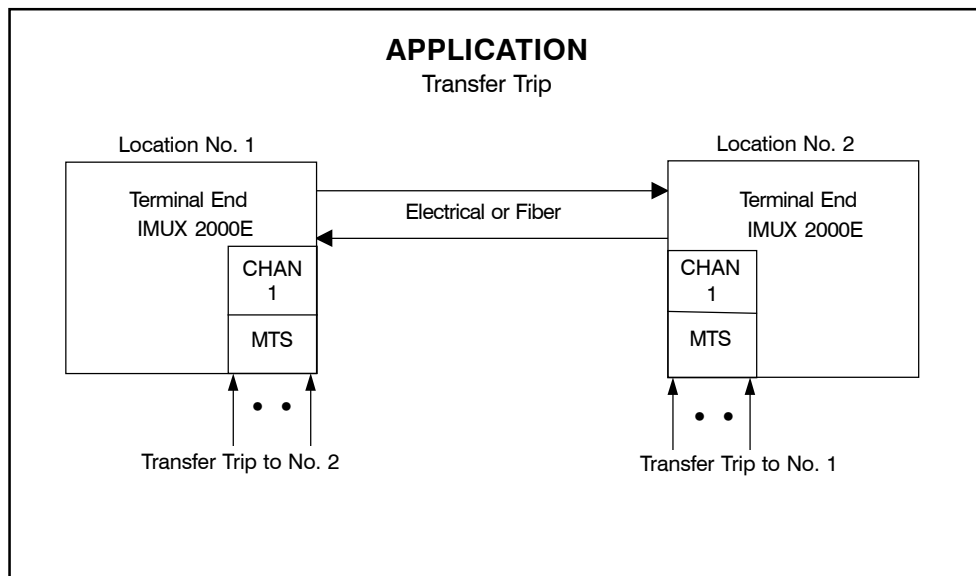
Modular Teleprotection System

The Modular Teleprotection System (MTS) is a channel card providing up to four independent, bi-directional transfer trip functions over a single DS0 time slot. Applicable teleprotection schemes include Direct Transfer Trip (DTT), Permissive Overreaching Transfer Trip (POTT), Permissive Underreaching Transfer Trip (PUTT), Directional Comparison Blocking and Directional Comparison Unblocking (DCU).

Both 2 and 4 function I/O Module Adapters are available with either solid-state or relay outputs.

The MTS offers remote access and control through an RS-232 port. The MTS has programmable logic which allows the user to independently set trip hold timers, input de-bounce timers, pre-trip timers and output form "A" or "B". Other features include channel delay measurement, a sequence of events log, an adjustable alarm timer delay, channel addressing for prevention of DS0 misconnections and indicators for each trip send and receive function as well as module status.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



MTS

Standard Specifications

Time Slots:

All four functions occupy a single DS0 time slot

Operational Mode:

Full duplex (transmit and receive)

Programmable Logic:

Trip Hold: 3-256 ms (1 ms increment)
Input De-bounce: 100 μ s
Output Form: normal/invert
Alarm Timer (delay): 0-2.5 sec. (10 ms increment)
Pre-trip Timer: 3-16 ms (1 ms increment)
Blocking: Enable/Disable
Sequence-of-Events Log: 20 records

Optically Isolated Inputs:

Operating Voltage Range:
48 Vdc 38-60 Vdc
125 Vdc 88-150 Vdc
250 Vdc 200-280 Vdc

Input threshold 1/2 nominal station battery.

Solid-State Outputs:

Maximum continuous output current: 1 Amp
Minimum output current: 20 ma
Maximum open circuit voltage: 280 Vdc
Maximum turn on delay: 100 μ s

Optional Relay Outputs:

Maximum continuous output current: 2A
(inductive)
Maximum surge current (100ms): 30 A
Maximum breaking current: 1 A resistive
Maximum open circuit voltage: 280Vdc
Maximum operate time: 5 ms

Alarm Relay:

Maximum continuous output current: 1A (inductive)
Maximum breaking current: 1A (resistive)
Maximum open circuit voltage: 280Vdc
Maximum operate time: 10 ms

System Performance:

Operate time (back-to-back): 3 ms (solid-state)
Dependability (IMUX in Frame): 99.9%
Security (10^{-3} BER on IMUX): 1×10^{-22}

SWC/Fast Transient:

Power supply, alarm contact, pilot wire interface & transfer trip interface meet the requirements of IEC 255-5, IEC 801-4 and NGTS 2-13 issue 2.

RFI Susceptibility:

The chassis with a representative set of channel modules meet the requirements of IEC 801-3 and NGTS 2-13 issue 2.

Temperature:

-20°C to +55°C

Humidity:

95% Non-condensing

Power Consumption:

2W max.

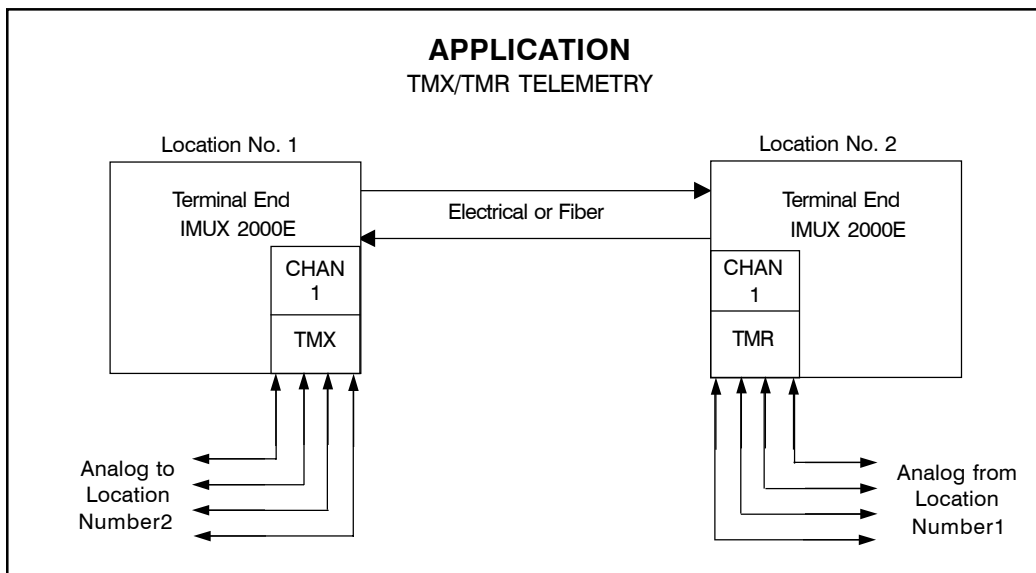
TMX/TMR

Telemetry Transmitter/Telemetry Receiver Modules

The RFL Telemetry System consists of an RFL TMX Telemetry Transmitter at one end of a T1/E1 system and an RFL TMR Telemetry Receiver at the other end. The system is used to duplicate up to four independent analog signals at a remote location using a single time slot. The analog inputs and outputs may be configured for either voltage or current signals.

The modules accept a wide range of input and output signals while maintaining a high level of stability. Test signals may be switched in for calibration and system verification. The modules support channel addressing to ensure proper DS0 connection.

The TMX and TMR modules are fully programmable and may be interrogated and configured remotely. If the TMR does not receive valid telemetry data over the T1/E1, it will report an Alert condition to the common logic.



TMX/TMR

Standard Specifications

TMX Specifications

Analog Input:

± 10 , ± 5 , ± 2.5 , or ± 1.25 V (programmable)
(For current mode a conversion resistor is added to terminal blocks on the I/O Module.)

Input Impedance:

Greater than 5.0 M(ohm) both differential and common mode

Accuracy:

@ 25°C: $\pm 0.05\%$ of full scale
Drift: 0.003%/°C over specified range
0.01% over six months

Resolution:

16 Bits

Frequency Response:

100 Hz @ 95% accuracy

Temperature:

+32°F to +131°F.

Humidity:

0 to 95% relative humidity, non-condensing.

Interface:

Terminal block connections on the MA-700 Module Adapter.

Power Requirements:

2.2W typical

TMR Specifications

Analog Output:

± 50 , ± 25 , ± 12.5 , and ± 6.25 mA, ± 10 V compliance (For voltage mode a conversion resistor is added to terminal blocks on the I/O Module.)

Accuracy:

@ 25°C: $\pm 0.05\%$ of full scale
Drift: 0.003%/°C over specified range
0.01% over six months

Resolution:

16 Bits

Frequency Response:

100 Hz @ 95% accuracy

Temperature

+32°F to +131°F.

Humidity:

0 to 95% relative humidity, non-condensing.

Interface:

Terminal block connections on the MA-700 Module Adapter.

Power Requirements:

2.5W typical

RFL 9720 Pilot Wire Interface

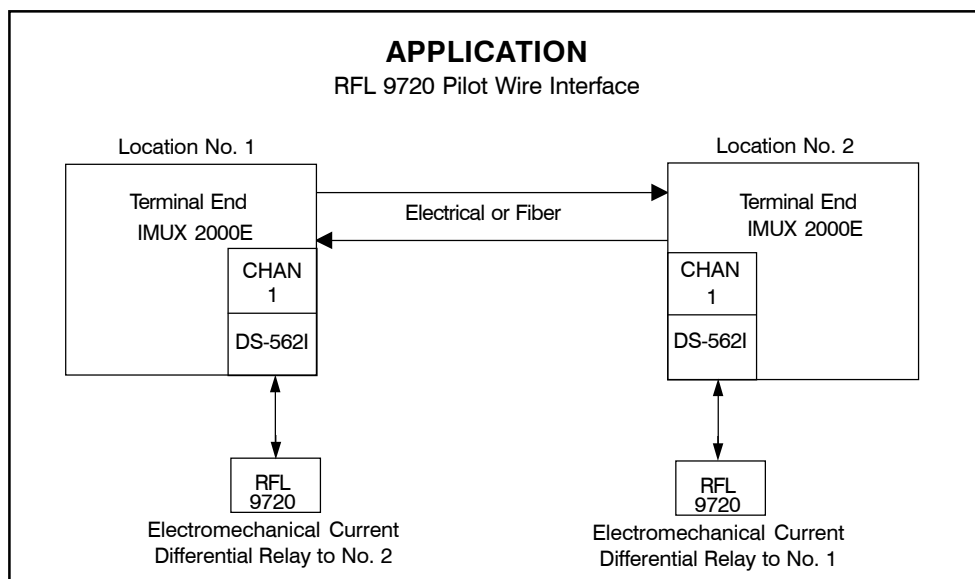
For pilot wire applications the IMUX 2000E presently uses the RFL 9720 digital interface. This interface provides a means of converting the 50/60 Hz output of the current differential relay to a digital DS0 channel compatible with the multiplexer. The interface is designed to connect directly to the pilot wire relay.

The RFL 9720 is a patented device (patent number 5,329,414) which appears to the relays as ideal pilot wires by providing zero reflected power into the local relay. Provision for loss of channel or loss of power will allow the user to select to default to overcurrent trip, block trip or timed block. The RFL 9720 has automatic self-testing and channel propagation monitoring and provides two level alarming. The interface measures the channel delay time and gives an alarm when this time becomes close to the operational limits of the relaying system. The interface will also squelch itself and provide a critical alarm once the delay exceeds the limit set for reliable system operation.

Front panel LED indications are available for troubleshooting and maintenance purposes. The interface includes a direct transfer trip feature with an optically isolated input, keyed from station battery voltage and an isolated 1 amp solid-state output. An RS-232 port is available for remote interrogation of the interface unit. The RFL 9720 Pilot Wire Interface unit can interface to the HCB (-1), MBCI and CPD pilot wire relays.

A separate product information sheet for the RFL 9720 is available upon request.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000E features.



RFL 9720

Standard Specifications

Time Slots:

One selectable DS0 Time Slot

Communications Interface:

Data Rate: 56-Kbps synchronous, EIA standard RS-422

Data Connector: 37-pin D- Subminiature connector (DC-37) wired as noted in EIA standard RS-449

Remote Access: RS-232 interface utilizing a 9-pin D-Sub-miniature connector (DB-9)

Compatible Relays:

ABB Types HCB and HCB-1, GEC Type MBCI and General Electric Type CPD

DTT Key Input:

42 VDC to 150 Vdc, 18 mA maximum

DTT Output:

Solid-state Form A (SPST); 4 Vdc to 200 Vdc, 10 mA to 1 ampere. The transient power dissipation is 400 watts for 1 ms (non-recurring). Surge current is 5 amperes for one second

Alarm Relay Outputs:

Two (Channel Delay and Channel Fail). Each relay has one set of Form C (SPDT) contacts rated for 125 Vdc maximum at 1 ampere.

SWC/Fast Transient:

ANSI C.37.90-1978 and ANSI C.37.90.1

Input Power Requirements:

48V: 42 to 58 Vdc, 500 mA nominal. 143 watts peak power consumption (24 watts continuous)

129 V: 95 to 150 Vdc, 200 mA nominal. 143 watts peak power consumption (24 watts continuous)

EMI Susceptibility:

ANSI C.37.90.2

Temperature:

-20° C to +55° C Operating

Humidity:

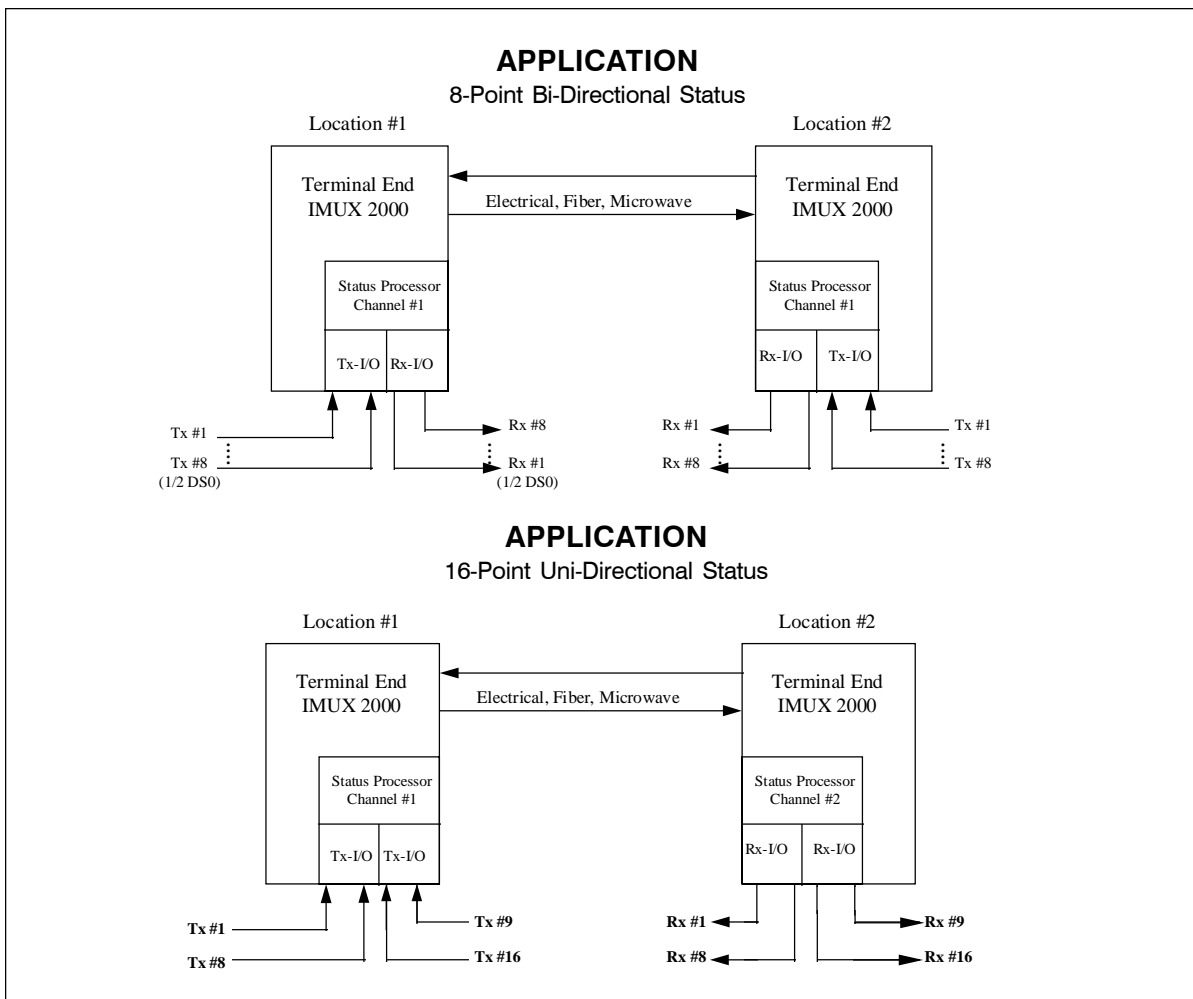
95% non-condensing

IMUX 2000E Status Module

The IMUX 2000 Status Module is configurable as either a 16-point transmitter, a 16-point receiver, or an 8-point transceiver. Configuration is made through jumper settings on the card and by using the appropriate module adapter. The mode of operation can be accessed remotely through the IMUX standard Network Management Software.

The transmitter occupies one direction of a single DSO. The transmitter has no receive capabilities and its portion of the DSO can be used by another device if needed. The receiver also occupies one direction of a single DSO. The receiver has no transmission capabilities and its portion of the DSO can be used by another device if needed. The transmitter will send its address every 1 millisecond. All communications include programmable addressing to prevent misconnections. There are 32 individual addresses.

Contact RFL Electronics Inc. for more information on this or any of the IMUX 2000 features.



IMUX 2000E

Status Module Standard Specifications

Status Transmitter

Scan Rate:

Less than 10 ms.

Controls and Indicators:

TX timeslots: 1-31

BUS direction: txa/txb

TX address: 0-32 (0 disables addressing)

Service: on/off

Interfaces:

Inputs: Optically isolated current

Main Comm.: 1 unidirectional DSO

Aux. Comm.: proprietary SCB

Optically Isolated Inputs

Input impedance: 3000 ohms

Logical "1" input: 3-10 ma

Logical "0" input: 0-0.25 ma

Environment:

Temperature: full perf @ (-20°C to 55°C)

RFI/EMI: C.37.90.2, IC-801-x

Humidity: 0% - 95% non-condensing

Power consumption: 2 watts nominal

Status Receiver

Output Control:

The polarity of the output can be set through the SCB on the receiver module

Update Rate:

10 ms or 100 ms

Control Indicators:

Controls are through the SCB with 16 LED indicators and an alarm LED

Interfaces:

Status outputs: form "A" relays

Main communications: 1 unidirectional DSO

Aux. communications: Proprietary SCB

Relay outputs:

Max. Output Current: 400ma @ 150 vdc, 1A@ 24vdc

Max. Open Circuit voltage: 150 vdc

Environment:

Temperature: full performance @ (-20°C to 55°C)

RFI/EMI: C.37.90.2, IEC-801-x

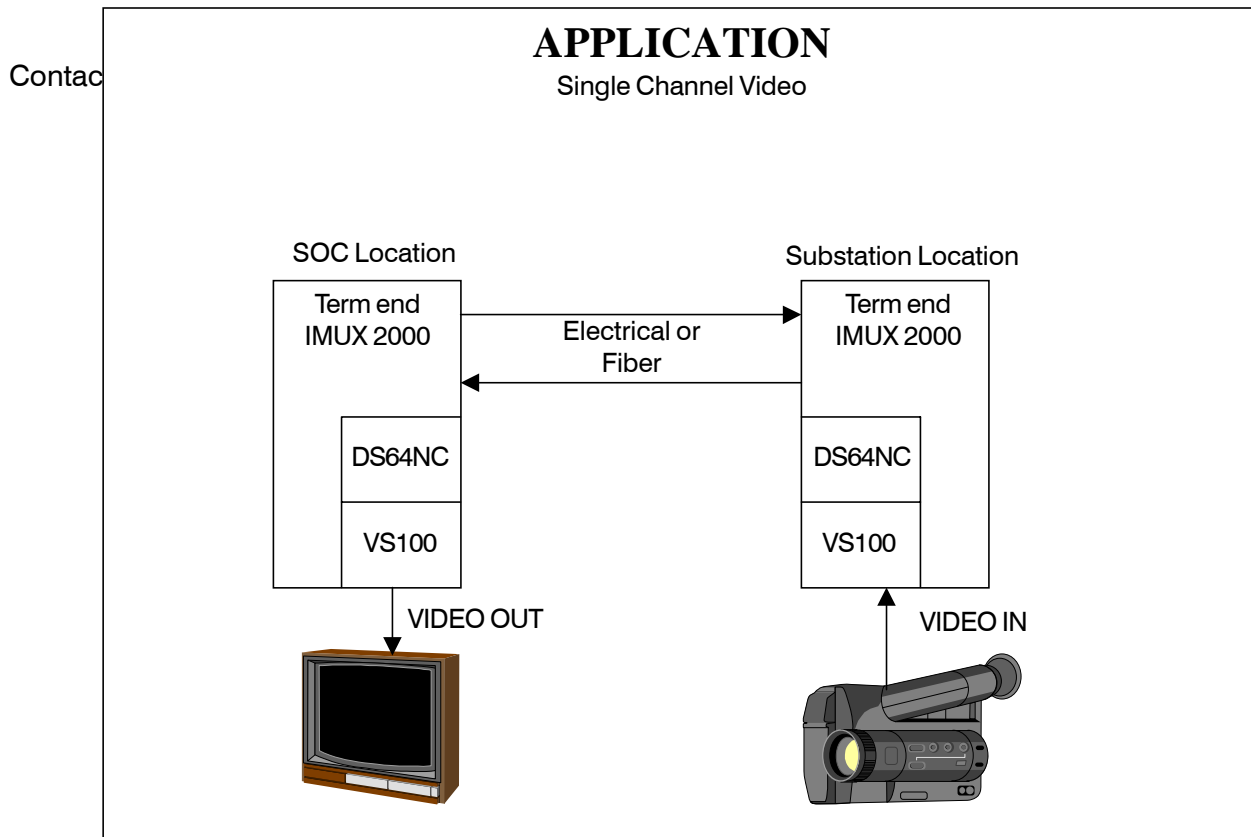
Humidity: 0%-95% non-condensing

Power consump: 2 watts nominal

VS-100 Variable Video System

The IMUX Variable Video System is a two module set that allows transmission of standard video signals over the IMUX 2000. One of the modules, the VS-100, takes in standard NTSC or PAL video and compresses it for transmission. The other module, the DS64NC provides for the remote programming of the system and multiplexes the signal onto the T1 path. A matching set of modules at the receiving station de-multiplexes and uncompresses the video. The output of the receiver can be connected to any standard video device.

The VVS takes up 3 card slots and can occupy from 1 to 31 timeslots. The resolution and quality of the video is set using switches on the modules. The data rate occupied by the channel determines the frame rate and is set either through switches or remotely using the NMS software. The data rate can be changed to dynamically match the requirements of the user.



VS-100

Standard Specifications

Configuration:

One video channel per card

Compression Algorithm:

ITU H.261

Video Input:

NTSC Composite 1 Vp-p 75 ohm

PAL Composite 1 Vp-p 50 ohm

Power Consumption:

1.5 A at 5V

Video Output

NTSC Composite 1 Vp-p 75 ohm

PAL Composite 1 Vp-p 50 ohm

Space Requirement

3 IMUX module slots

Frame Rate:

1-20 fps (dependent on bandwidth allotted and amount of movement per frame)

Companion modules required

DS-64NC and MA412

Module Adapter Required:

MA-800

Bandwidth Required:

64-2048 kb/s

Video Interface:

1 BNC Connector

Resolution:

352 x 288

Temperature & Humidity:

-20°C to +55°C, 0-95% non-condensing

RFL Electronics Inc.

Proudly Introduces

**Its Third Generation
“INTELLIGENT” MULTIPLEXER,**

**THE IMUX
2000E**

RFL was the first to develop and manufacture substation hardened multiplexers and has remained committed to its excellence through product enhancements. That commitment has resulted in the most versatile multiplexer today - The IMUX 2000E. With a wide range of Channel Cards, the IMUX 2000E appeals to both Communications and Teleprotection Engineers.

Greater resilience for protective relaying can finally be applied over non-proprietary SDH equipment. The IMUX 2000E is available in two versions, Terminal End and Drop-and-Insert which has through delays of less than 25 microseconds. This makes the IMUX 2000E ideal for protective relaying applications. There are a variety of communication interfaces available which include Fiber Optics at 850nm, 1300nm, 1550nm and ITU G.703 electrical interfaces. The IMUX 2000E can be configured remotely or through a front panel user interface on the common logic module.

The IMUX 2000E is a compact unit that is modular in design and is a system which provides downward and upward compatibility. For a product that meets and exceeds your multiplexing needs now or in the future.

Make the “intelligent” choice...The IMUX 2000E.