IMUX 2000
8-Port DACS
Your world is changing and so are we.

At RFL, we know your needs change much faster than your infrastructure. Our comprehensive line of solutions meets you wherever you are to help you bridge the gap from yesterday to tomorrow.

We aren’t just engineering products. We are continuously innovating to give legacy equipment the advantage of today’s technologies. Our highly adaptable solutions offer more features for more flexibility and a custom fit for your specific needs.

When we deliver, we also deliver our reputation. So when you open that box, you’re opening a custom-engineered solution, factory-tested and ready for deployment.

And as long as you own that equipment, you own the attention of RFL. We see you as our partner and we want to ensure that our solution is working for you – now and over the long haul.

RFL – delivering solutions that work. Period.
Management, protection and routing of critical T1/E1 traffic

The IMUX 2000 8-Port T1/E1 DACS is designed for stand-alone operation and/or to interface with the IMUX 2000 Multiplexer to support various types of network topologies including “Star”, “Hot-Standby” and “Rings.”

The IMUX 2000 8-Port T1/E1 DACS, provides full cross-connect capability as well as a reliable level of system restoration. The RFL DACS enables the termination of up to eight [8] T1/E1 ports in a common platform while also providing full DS0 Time Slot Interchange capability. Redundant DACS modules are available for critical applications, which cannot tolerate single point of failure network architectures.

Communications interface options for the DACS include built in T1 CSU, or fiber optic interface adapters, using Code Mark Inversion (CMI) encoding technology. In the event the application is time sensitive in nature the RFL DACS can be configured as an Intelligent Line Switch (ILS) in order to provide ultra high speed path switching. System restoration is accomplished through the use of alternate DS0, Time Slot Interchanged maps. The alternate maps are predetermined and pre-programmed through our user friendly Network Management Software. An alternate DS0 map is invoked automatically upon detection of T1/E1 failures (e.g. AIS, Loss of Frame, excessive BER). The time necessary to switch to an alternate map, upon detection of failure, is programmable down to 1 millisecond

Key Features and Benefits

Optimizes transmission efficiency
Drastically reduces overall T1/E1 line costs
Provides T1/E1 connectivity to several sites
Ideal for edge access and data back haul
Groom/Concentrate/Hub multiple T1/E1 links
Consolidation of Enterprise network traffic
Enables dual T1/E1 Ring interconnection
Offers automatic re-routing capabilities
Redundant DACS module and power supply
Full Time Slot Interchange (TSI) capability
1 ms High Speed Intelligent Line Switch
Rugged design (SWC, EMI, RFI, Temp)
Intuitive GUI with color coded DACS maps
Optional SNMP interface compatibility
Front access T1/E1 maintenance Jack-fields
Up to 8 T1/E1 ports, fiber optic or electrical
DACS map and Tri-color port status Displays
Electrical to fiber optic DS1 migration

Because RFL™ and Hubbell® have a policy of continuous product improvement, we reserve the right to change designs and specifications without notice.
Product Applications

Electric Utilities
(Investor Owned, Municipal, Cooperatives, Independent Power Producers)
- Inter-substation communications
- System protection control and monitoring
- Corporate Wide Area Networks
- Substation automation
- Remote station data backhaul
- SONET/ATM backbone access

Transportation
(Traffic, Intelligent Transportation Systems, Airports, Rail/Transit)
- Advanced Transportation Management Systems (ATMS)
- Traffic operation center data concentration
- Wayside communications and signaling for metro/rail
- Airport enterprise solutions

Telco
(RBOC, CLEC, ILEC, ISP)
- Voice, data, video transport
- DSO grooming
- DS1 concentration
- Fractional T1 to subscribers
- Public and private networks

T1 Specifications

**DS1 Inputs/Outputs Interface:**
- DSX-1 interface per ANSI T1.403-1995
- T1 CSU line build outs of –7.5dB, -15dB, and –22.5dB

**Rate:**
- **Input:** 1.544 Mbps ± 30 PPM, using internal timing
- **Output:** 1.544 Mbps ± 30 PPM

**Pulse Amplitude:**
- Per ANSI T1.403-1995

**Formats:**
- Extended Superframe (ESF) per AT&T 62411
- Superframe (SF) per AT&T 43801

**Line Codes:**
- Bipolar with 8 Zero Substitution (B8ZS)
- Alternate Mark Inversion (AMI)

**Line Impedance:**
- Selectable 75 or 120 ohm resistive (nominal)

**Avg. Reframe Time:**
- <25 ms or <1 ms with Fast Reframing channel (FRC)
- enabled (FRC reframe for single frame data payload only)

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Figure 1 - RFL DACS application DSO grooming of fractional T1.

Figure 2 - RFL DACS configured as an Intelligent Line Switch for time sensitive high speed switching applications.

**E1 Specifications**

**E1 Inputs/Outputs:**
- **Interface**
- Conforms to CCITT G.703
- **Rate:**
  - Input: 2.048 Mbps ± 50 ppm, using internal timing
  - Output: 2.048 Mbps ± 200 ppm, when not loop or through timed
  - 2.048 Mbps ± 130 ppm, when loop or through timed
- **Pulse Shape:**
  - Per CCITT G.703
- **Formats:**
  - Frame Format CCS or CAS as per CCITT G.704 in 30 channel and 31 channel modes
- **Line Codes:**
  - High Density Bipolar; Order 3 (HDB3) per CCITT G.703 or Alternate Mark Inversion (AMI)
- **Line Impedance:**
  - Selectable 75 or 120 ohm resistive (nominal)
- **Average Reframe Time:**
  - <25 ms or <1 ms with Fast Reframing channel (FRC)
  - enabled (FRC reframe for single frame data payload only)
**Product Specifications**

**General Specifications**

**Propagation Delay:**
- **DS1/E1 through Delay DACS:** 1 to 3 frames, 2 frames average (250 μsec) for each pass through
- **DS1/E1 through Delay ILS:** 25 μsec for each signal pass through

**Switch Time:**
- DACS DS0, ILS Alternate Maps Switch Time: Programmable down to 1ms

**Environmental:**
- **Operating Temperature:** -20° to +55°C operating
- **Humidity:** 0 - 95% Non-condensing
- **SWC & Fast Transient:** ANSI C.37.90-1989 & ANSI C.37-90.1
- **EMI:** ANSI C.37.90.2
- **FCC Compliance:** FCC Part 15 Class A

**PHYSICAL**

**Dimensions:**
- Height: 5.25” (134 mm)
- Width: 19” (483mm) Wide
- Depth: varies depending on I/O in rear of chassis. Available in 23” width mounting.

**Weight:**
15 lbs (6.8 kg). for typical fully loaded shelf.

**Power Supply:**
The RFL DACS has the capability to be equipped with a secondary plug-in power supply for redundancy. The secondary power supply operates on a hot-standby concept versus a load sharing technique:

**Input Voltage**
- 24 VDC: 19.0 to 29.0 VDC
- 48/125 VDC: 38.0 to 150.0 VDC
- 220 VAC: 180.0 to 265.0 VDC
- 120 VAC: 90.0 to 130.0 VAC
- 250 VDC: 200.0 to 300.0 VDC
**Power Supply Capacity:** Typically 75 Watts

**Optical Interface Adapters:**

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>Emitter Type</th>
<th>Fiber Type</th>
<th>System Gain</th>
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</thead>
<tbody>
<tr>
<td>850</td>
<td>LED</td>
<td>Multimode</td>
<td>25 dB</td>
</tr>
<tr>
<td>1300</td>
<td>LED</td>
<td>Multimode</td>
<td>25 dB</td>
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<tr>
<td>1300</td>
<td>LED</td>
<td>Singlemode</td>
<td>19 dB</td>
</tr>
<tr>
<td>1300</td>
<td>Laser</td>
<td>Singlemode</td>
<td>36 dB</td>
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<tr>
<td>1550</td>
<td>Laser</td>
<td>Singlemode</td>
<td>30 dB</td>
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</table>

**Alarms:**
- **Alarm Types:**
  - Alert: Cautionary conditions that do not prevent multiplexer operation
  - Alarm: Conditions that directly affect multiplexer operation

**Interface:**
- Front Panel indicators and a RS-232 port for remote access and interrogation.
- Shelf, Form C alarm relays rated for 100 mA at 250 Vdc

**Test and Diagnostics**
- **Loopbacks:** Remote, Local and Analog DS0 & DS1/E1
- **Test pattern:** PRBS pattern generation/detection
- 16-bit loop-up and loop-down code generation and detection.

**Specifications Compliance:**
- ANSI T1.403-1995; ANSI T1.231-1993; ANSI T1.408; AT&T TR54016; AT&T TR62411; ITU G.703,G.704, G.706; G.736; G.775; G.823; G.932; I.431; O.151; O.161; ETSI ETS 300 011; ETS 300 166;ETS 300 233; CTR4; CTR12; IEC 255-5 & IEC 801-4

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April 2013
The RFL DACS comes with a user-friendly Windows™ based graphical user interface. This enables the administrator a large amount of flexibility in configuring which DACS map will be utilized and under which pre-determined criteria.

The on board craft interface provides the path to access the NMS either locally or remotely. One will have the ability to provision the system, program the DACS maps, interrogate for alarms, and allow for operation and maintenance.

The NMS offers intuitive color-coded DS0 cross-connect maps to facilitate system programming and to reduce the possibility of human error. Optional SNMP access gateway modules are available to interface the network management system in stand-alone system applications.

### Ordering Information

**IMUX 2000 8-Port DACS-R T1/E1 Equipment List**

<table>
<thead>
<tr>
<th>Module Arrangement</th>
<th>Power Supplies</th>
<th>Jackfield and Display</th>
<th>SAG Module</th>
<th>Port (1-6) Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single DACS Without Redundancy</td>
<td>Single 24 Vdc</td>
<td>With Display, no Jackfield</td>
<td>No SAG Module or EO</td>
<td>No Interface</td>
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<tr>
<td>Single DACS Redundant Ready</td>
<td>Redundant 24 Vdc</td>
<td>With Display and Jackfield</td>
<td>SAG Module and EO</td>
<td>T1/E1 BNC</td>
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<td>Dual DACS with Redundancy</td>
<td>Single 48/125 Vdc</td>
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<td>Dual 48/125 Vdc</td>
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<td>T1/E1 DoIP</td>
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<td>E1 BNC</td>
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<td>Single 220 Vac</td>
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