CITY OF GRAND ISLAND

ADVERTISEMENT FOR BIDS
FOR
Nineteen (19) Transmission Distance Relays

Sealed bids will be received at the **Office of the City Clerk, 100 East First Street, Grand Island, NE 68801, until** 2:15 pm. **(Local Time),** October 13, 2011 for furnishing Nineteen (19) Transmission Distance Relays, FOB the City of Grand Island. Quotes will be publicly opened at this time at the Office of the City Clerk, 100 East First Street, Grand Island, NE. Bids received after the specified time will be returned unopened to sender.

Specifications are on file in the office of the Purchasing Division. Bids shall be submitted on forms that will be furnished by the City.

Each bidder shall submit with their bid a certified check, cashiers check, or bid bond payable to the City Treasurer in an amount not less than five percent (5%) of the bid price which shall guarantee good faith on the part of the bidder and the entering into a contract within 14 days, at the bid price, if accepted by the City. **Your certified check, cashiers check or bid bond must be submitted in a separate envelope attached to the outside of the envelope containing the bid.** Each envelope must be clearly marked indicating its contents. Failure to submit the necessary qualifying information in clearly marked and separate envelopes will result in your bid not being opened or considered. Bid bonds must be issued by surety companies authorized to do business in the State of Nebraska.

Bids will be evaluated by the purchaser based on price, delivery, quality, and adherence to specifications. Each bidder shall supply four (4) copies of equipment specifications. The Purchaser reserves the right to reject any or all bids, to waive technicalities, and to accept whichever bid that may be in the best interest of the City.

No Company may withdraw its bid for a period of 30 days after date of bid opening.

RaNae Edwards,
City Clerk

Issue Date: _____

**GENERAL SPECIFICATIONS AND BID SHEET
FOR
<u>NINETEEN (19) TRANSMISSION DISTANCE RELAYS</u>**
<u>CITY OF GRAND ISLAND, NEBRASKA</u>

Sealed bids will be **received at the office of the City Clerk**, 100 East First St., Grand Island, NE 68801 or P. O. Box 1968, Grand Island, Nebraska, until <u>2:15 pm </u>(Local Time) on <u>October 13th, 2011</u>, for furnishing <u>Nineteen (19) Transmission Distance Relays</u> as specified in these bidding documents, FOB Grand Island, NE.

Exceptions to Specifications - Any bidder who has <u>exceptions to any specifications and requirements listed in the bidding documents must so state in the space provided below</u>. Exceptions should also be noted in the blanks provided in the detailed specifications. It is the bidder's responsibility to clearly outline any exceptions. Failure by bidder to outline exceptions will require the successful bidder to comply with the specifications.

Exceptions to specifications:
_____
_____
_____

<u>Attached are detailed minimum specifications</u>. The following <u>general specifications </u>also apply to this bid.

Bid Bond	Each bidder shall submit with their bid a certified check, cashiers check or bid bond payable to the City Treasurer in an amount not less than five percent (5%) of the bid price which shall guarantee good faith on the part of the bidder and the entering into a contract within 14 days, at the bid price, if accepted by the City. **Your certified check, cashiers check or bid bond must be submitted in a separate envelope attached to the outside of the envelope containing the bid.** **Each envelope must be clearly marked indicating its contents. Failure to submit the necessary qualifying information in clearly marked and separate envelopes will result in your bid not being opened or considered**. Bid bonds must be issued by surety companies authorized to do business in the State of Nebraska.
Bid Submittal	All envelopes submitted by Bidder must state "Transmission Distance Relays, Opening October 13th" on the face of envelope.
Manuals	Refer to specifications.
Warranty	The equipment shall carry the standard warranty (no less than one year); bidder should include warranty details with the bid; failure to comply may cause bid rejection.
Descriptive Literature	The bidder shall attach hereto, and it shall be made part of this bid, regularly printed literature as published by the factory which sets out and fully describes the equipment to be furnished in the bid. This literature or other supplemental information shall clearly indicate compliance with each and every item of these Specifications. Failure to indicate compliance may be cause for rejection of

bid.

Optional Equipment	The general and detailed specifications are the minimum requirements. Bidder may include optional equipment if desired. Optional equipment should be noted as such.
OSHA & ANSI Requirements	In addition to other specified requirements, the equipment shall meet all current Occupational Safety and Health Administration and American National Standards Institute requirement specifications.
Award	Upon approval by the Grand Island City Council, a City of Grand Island Utilities Department Purchase Order shall be issued to the successful bidder.
Delivery	Equipment is to be delivered from assembly point to Grand Island, Nebraska, by commercial freight or truck. Delivery will be to <u>Phelps Control Center, 700 E Bischeld St., Grand Island, NE 68801.</u> The winning bidder shall contact Travis Spiehs at (308) 385-5462 when the equipment has shipped out. Delivery time shall be between 8:00 and 11:30 am or 1:30 and 4:30 pm CST Monday through Friday. The City of Grand Island is not responsible for delivery delays due to failure to provide delivery notice.
Delivery Date	Each bidder shall state in his bid a realistic delivery date for this equipment. Award winning bidder must deliver within quoted delivery time.
Inspection	The equipment must be new, the latest make or model, unless otherwise specified. Prior to approving the invoice for payment, the City reserves the right to thoroughly inspect and test the equipment to confirm compliance with specifications. Any equipment which does not meet the City's requirements will be returned at vendor's expense for correction. All specified data, diagrams and manuals must be received prior to approval of invoice.
Payment	The invoice will be paid after approval at the next regularly scheduled Council meeting occurring after departmental approval of invoice; the City Council typically meets the second and fourth Tuesday of each month. Invoices must be received well in advance of Council date to allow evaluation and processing time.

Fair Employment Practices - Each bidder agrees that he/she will not discriminate against any employee or applicant for employment because of age, race, color, religious creed, ancestry, handicap, sex or political affiliation.

Data Privacy - Bidder agrees to abide by all applicable Local, State, and Federal laws and regulations concerning the handling and disclosure of private and confidential information concerning individuals and corporations as to inventions, patents and patent rights. The bidder agrees to hold the City harmless from any claims resulting from the bidder's unlawful disclosure or use of private or confidential information.

Independent Price Determination - By signing and submitting bid, the bidder certifies that: the prices in the bid have been arrived at independently, without consultation, communication or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor.

Clarification of Specification Documents - Vendors shall promptly notify Travis Burdett at (308) 385-5466

of any ambiguity, inconsistency or error that they may discover upon examination of the specifications. Interpretations, corrections and changes made to the specifications will be made by written addenda. Oral interpretations or changes to the specifications made in any other manner will not be binding on the City; and bidders shall not rely upon such interpretations or changes.

Gratuities and Kickbacks - City Code states that it is unethical for any person to offer, give, or agree to give any City employee or former City employee, or for any City employee or former City employee to solicit, demand, accept, or agree to accept from another person, a gratuity or an offer of employment in connection with any decision, approval, disapproval, recommendation, or preparation of any part of a program requirement or a purchase request, influencing the content of any specification or procurement standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any proceeding or application, request for ruling, determination, claim or controversy, or other particular matter, pertaining to any program requirement or a contract or subcontract, or to any solicitation or proposal therefore. It shall be unethical for any payment, gratuity, or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier subcontractor or any person associated there within, as an inducement for the award of a subcontract or order.

BID FORM
CITY OF GRAND ISLAND, NEBRASKA
(All bids must be submitted on this form)

TO THE CITY COUNCIL, CITY OF GRAND ISLAND, GRAND ISLAND, NE

The Undersigned bidder, having examined all specifications and other bidding documents, and all addenda thereto, and being acquainted with and fully understanding all conditions relative to the furnishing of the specified equipment to the City of Grand Island, NE hereby proposes to furnish and deliver such equipment FOB Grand Island, NE, at the following price:

ITEM DESCRIPTION: COST
Total Base Bid:

                                                                                          $_____

7% Nebraska Sales Tax $_____
TOTAL BID PRICE * $_____

∗   The City of Grand Island, Utilities Department **_does_** pay sales tax. If bidder fails to include sales tax in the bid price or takes exception to including sales tax in the bid price, the City will add a 7% figure to the bid price for evaluation purposes; however, the City will only pay actual sales tax due.

If awarded the contract, the undersigned bidder agrees to deliver the specified equipment within
 _____ days from date of order.

To allow for City processing time, terms shall be Net 30.
Bidder acknowledges receipt of Addendum Number(s) _____ and has considered addendum information in bid preparation.

Attached to the bid is all supplementary information requested in the bidding documents.

_____
Bidder Company Name   Date

_____
Company Address

_____
Name of Person Completing Bid (please print)/Signature

Telephone #: _____   Fax #: _____

CITY OF GRAND ISLAND RESERVES THE RIGHT TO ACCEPT OR REJECT ANY OR ALL BIDS.

Note: Any exceptions to specifications must be noted in the space provided on Page 1 of General Specifications.

Detailed Specifications for Nineteen (19) Transmission Distance Relays

Scope

The Grand Island Electric Department is soliciting bids for the purchase of nineteen (19) digital transmission line distance relays to be used as replacements for electro-mechanical and older digital relays currently in use on the Grand Island 115 kV transmission loop. Fourteen relays will be used to upgrade seven line segments of the 115 kV transmission loop while two will be installed in a future substation and three for spares.

Overview

The Grand Island Electric Department is a municipally owned electric utility, with a summer peak demand in excess of 165 MW. The Electric Department serves its load with local generation and distribution substations on a 115 kV transmission loop. A single-line drawing of the electric system Power Supply is included with these specifications. The north half of the 115 kV transmission loop was upgraded to digital relaying in 2001 with the addition of substations E and F. The north half utilizes a current differential scheme as primary protection and an overcurrent scheme as backup. It is the desire of the Grand Island Electric Department to replace the backup protection on the north half to distance protection. The south half of the loop continues to utilize electro-mechanical relaying. It is the desire of the Grand Island Electric Department to upgrade the south half of the loop in order to provide increased reliability and functionality.

Physical Dimensions and Configurations

All nineteen relays will be horizontally mounted in a 19 inch rack. Dimensions of the relays shall be provided with the bid.

Power Supply

The relays shall operate on 125V DC power supply. The manufacturer shall state the voltage range of power supply.

Analog Inputs

The relay must accept a current transformer (CT) ratio range of 100/5 to 3000/5 and must be software selectable. The relay should be able to accept 15 A continuous, 300 A for one second. The manufacturer shall state the range of CT ratios the relay can accept.

The potential transformer (PT) input to the relay will be 67 VL-N, three-phase, four-wire, however, in the event the relay be used with another PT ratio, the relay must be able to be software selectable to accept a range of PT ratios from 1 to 6000. The relay should be able to accept 150 VL-N continuous, 400 Vac for ten seconds. The manufacturer shall state the range of PT ratios the relay can accept.

The protection CT and PT input frequency will be 60 Hz.

Programmable Control Inputs and Outputs

Control Inputs

The relay's wet control input voltage is 125V DC. The relay will have a minimum of 12 programmable inputs for various logical control and protection functions.

Control Output Contacts

The relay will have a minimum of 8 programmable output contacts in addition to the standard breaker close and open contacts for two breakers. A relay alarm output should also be provided to signal loss of protection.

The output contacts must have the following ratings:

-6 A continuous carry
-30 A make per IEEE C37.90 : 1989
-30 A for one second
 -Breaking Capacity of 10 A DC for trip contacts

Ratings and Tolerances

The relays must include Surge Withstand Capabilities and fast transient tests per ANSI C37.90.1 and IEC 255-22-1 class III and 255-22-4 class IV for all connections except communications or AUX ports

The relay must include EMI ratings per ANSI C37.90.2

The relays must be able to operate in a range of -20C to +65C (-4F to 150F).

Protective Functions

Distance

Relays should include four zones of phase and ground distance protection with positive sequence voltage polarization. Additional reactance, directional, and overcurrent supervision shall be included. Phase and ground protection shall include mho and quadrilateral characteristics. Zero-sequence compensation shall be available for ground distance zones. The relay should provide communication-aid line protection schemes, such as DTT, POTT and etc. The compensating factors shall be provided as both magnitude and angle. The communication-aid protection shall be accomplished via an RS-232 communications path to an identical relay at the opposite end of the protected transmission line. The relay must interface with an RFL IMUX-2000 multiplexer using a 9 pin port. The pertinent portion of the IMUX manual is included with these specifications.

Overcurrent

Relays should include an instantaneous overcurrent element and a time overcurrent element for phase and ground connections. Time curves should include inverse, very inverse, extremely inverse, and definite time. Directional elementary should be available for protection function. The pickup setting should be adjustable over the range of the rated current input.

Reclosing

Relays should include pre-defined one, two, three and four shot reclosers with instantaneous and user adjustable time delayed reclose shots. Relay should have synchronism-check reclosing functions, and reclosing functions for two breakers. The reclosing function could be supervised by protection function elementary such as overcurrent, voltage, frequency and etc. (two breakers reclosing for

Under/Overvoltage

Relays should include under and overvoltage protection on the attached elements for both phase and neutral. These elements should be time dependent.

Breaker Failure

The relay should provide the breaker failure protection function.

Metering

The relay should be capable of metering voltage (phasors, true RMS values, symmetrical components), current (phasors, symmetrical components, true RMS values), real, reactive

and apparent power, power factor, and frequency. The relay should include an option to log any of these values into memory with a user defined trigger and sampling rate.

The relay shall be able to display any desired values on a front panel in real time as programmed.

Fault Recording

The relay shall have the capability to store raw sampled transient data with programmable sampling rate (at least 30 samples per cycle) with a provision for minimum of 36 records to store/monitor information about any physical I/O point or internal digital and analog quantities.

Communications

The relay shall provide at minimum one serial port on the front and rear of the relay. Relays should support protocols DNP3.0, Modbus RTU, and Modbus TCP/IP. The relay clock shall be capable of being synchronized with an IRIG-B signal to allow synchronism with other connected devices. The relay shall allow for SNTP network-based time synchronization.

Additional Materials and Services

Communication Cables

Two communication cables will be provided to allow communication between the relay and a USB port on a computer. In addition, one RS-232 cable per relay should be provided for communication between the relay and the IMUX-2000 multiplexer.

Software

Two CD-ROMs containing the windows-based communications software will be provided. Any necessary drivers and licenses required for communications and programming shall also be provided.

Instruction Manuals

Ten hardcopies of the relay instruction manual will be provided. Two electronic copies of the relay instruction manual will be provided. The electronic copies may be included on the above-mentioned CD-ROMs.

Training

The vendor and/or manufacturer shall supply one day of on-site training to provide hands-on instructions on the use and features of the relays. This visit will be independent from any visits that may be required to resolve problems associated with installation.

Configuration Upon Receipt

The relays shall come fully assembled, tested and calibrated.

Delivery

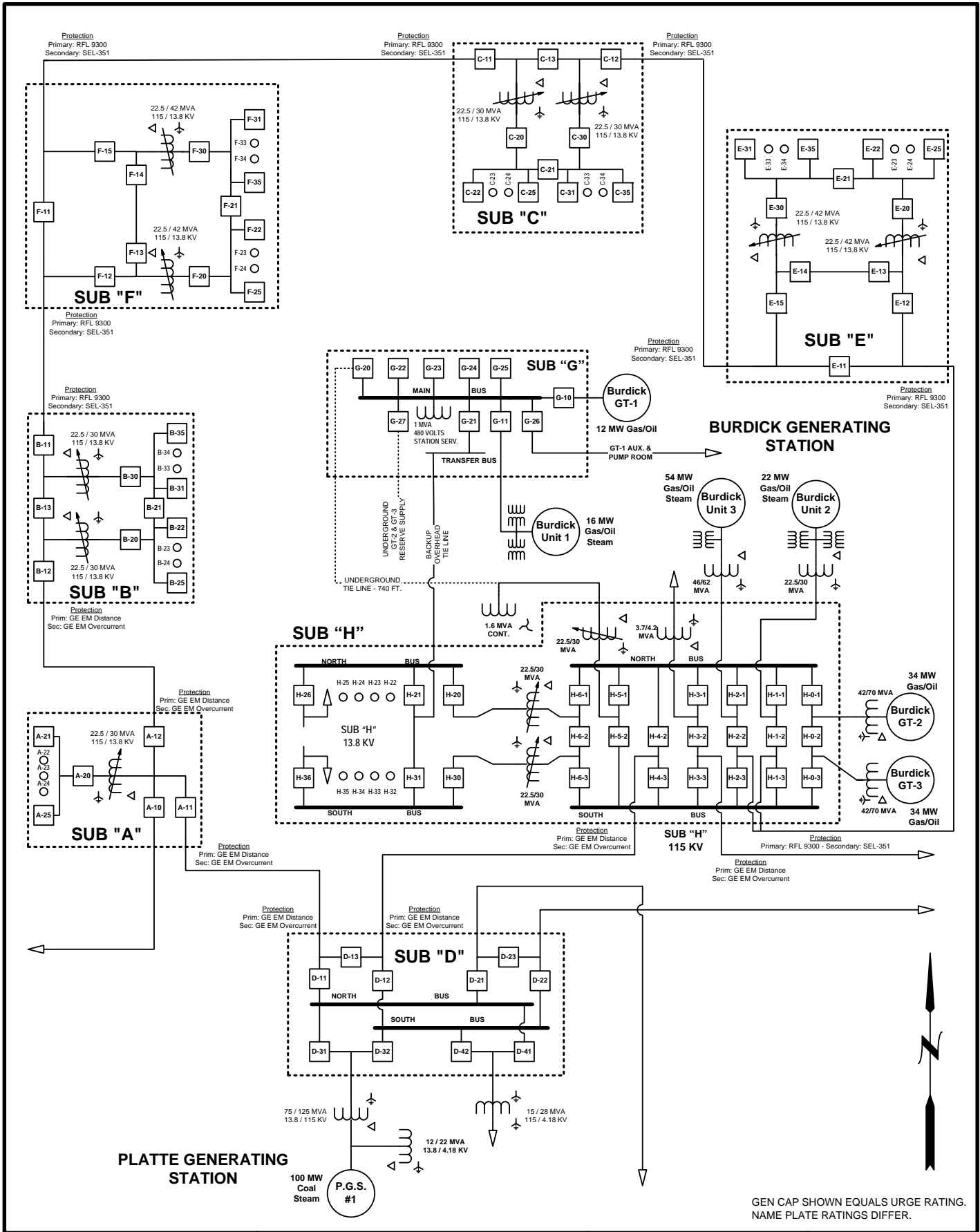The bidder shall state in their bid the approximate delivery time for their product. Delivery time shall be considered when evaluating the bids received.

References

The bidder shall provide a list of five (5) U.S. based references that are currently using the product. Bid evaluation shall include reference checks.

Exceptions

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

POWER SUPPLY

SUB "F"

Protection
Primary: RFL 9300
Secondary: SEL-351

22.5 / 42 MVA
115 / 13.8 KV

F-15, F-14, F-11, F-12, F-13, F-30, F-20, F-21, F-22, F-25, F-31, F-33, F-34, F-35, F-23, F-24

22.5 / 42 MVA
115 / 13.8 KV

SUB "C"

Protection
Primary: RFL 9300
Secondary: SEL-351

22.5 / 30 MVA
115 / 13.8 KV

22.5 / 30 MVA
115 / 13.8 KV

C-11, C-13, C-12, C-20, C-30, C-21, C-22, C-23, C-24, C-25, C-31, C-33, C-34, C-35

SUB "E"

Protection
Primary: RFL 9300
Secondary: SEL-351

E-31, E-33, E-34, E-35, E-22, E-23, E-24, E-25, E-21, E-30, E-20, E-14, E-13, E-15, E-12, E-11

22.5 / 42 MVA
115 / 13.8 KV

22.5 / 42 MVA
115 / 13.8 KV

SUB "B"

Protection
Primary: RFL 9300
Secondary: SEL-351

22.5 / 30 MVA
115 / 13.8 KV

B-11, B-13, B-12, B-30, B-21, B-20, B-35, B-34, B-33, B-31, B-22, B-23, B-24, B-25

22.5 / 30 MVA
115 / 13.8 KV

SUB "A"

Protection
Prim: GE EM Distance
Sec: GE EM Overcurrent

22.5 / 30 MVA
115 / 13.8 KV

A-21, A-22, A-23, A-24, A-25, A-20, A-12, A-10, A-11

SUB "G"

Protection
Primary: RFL 9300
Secondary: SEL-351

G-20, G-22, G-23, G-24, G-25, G-27, G-21, G-11, G-26, G-10

MAIN   BUS

Burdick GT-1
12 MW Gas/Oil

1 MVA
480 VOLTS
STATION SERV.

TRANSFER BUS

UNDERGROUND
GT-2 & GT-3
RESERVE SUPPLY

BACKUP
OVERHEAD
TIE LINE

UNDERGROUND
TIE LINE - 740 FT.

GT-1 AUX. &
PUMP ROOM

BURDICK GENERATING STATION

Burdick Unit 1
16 MW Gas/Oil Steam

54 MW Gas/Oil Steam
Burdick Unit 3

22 MW Gas/Oil Steam
Burdick Unit 2

1.6 MVA CONT.

SUB "H"

SUB "H" 13.8 KV

NORTH   BUS
H-26, H-25, H-24, H-23, H-22, H-21, H-20

SOUTH   BUS
H-36, H-35, H-34, H-33, H-32, H-31, H-30

22.5/30 MVA
22.5/30 MVA

Protection
Prim: GE EM Distance
Sec: GE EM Overcurrent

22.5/30 MVA

3.7/4.2 MVA

NORTH   BUS
H-6-1, H-5-1, H-3-1, H-2-1, H-1-1, H-0-1

H-6-2, H-5-2, H-4-2, H-3-2, H-2-2, H-1-2, H-0-2

SOUTH   BUS
H-6-3, H-4-3, H-3-3, H-2-3, H-1-3, H-0-3

46/62 MVA

22.5/30 MVA

SUB "H" 115 KV

34 MW Gas/Oil
Burdick GT-2
42/70 MVA

Burdick GT-3
42/70 MVA
34 MW Gas/Oil

Protection
Prim: GE EM Distance
Sec: GE EM Overcurrent

Protection
Primary: RFL 9300 - Secondary: SEL-351

SUB "D"

Protection
Prim: GE EM Distance
Sec: GE EM Overcurrent

Protection
Prim: GE EM Distance
Sec: GE EM Overcurrent

D-13, D-11, D-12, D-23, D-21, D-22

NORTH   BUS

SOUTH   BUS

D-31, D-32, D-42, D-41

PLATTE GENERATING STATION

75 / 125 MVA
13.8 / 115 KV

15 / 28 MVA
115 / 4.18 KV

12 / 22 MVA
13.8 / 4.18 KV

100 MW Coal Steam

P.G.S. #1

GEN CAP SHOWN EQUALS URGE RATING.
NAME PLATE RATINGS DIFFER.

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT

POWER SUPPLY

DRN. BY:	H.M.G./J.L.M.	DWG. NO. S-56-11
DATE :	01/28/99	
SCALE :	NONE	
SHEET :	1 OF 13	Rev. 4/12/2006

RFL Electronics Inc.

I N S T R U C T I O N   D A T A

RFL DA-191A Asynchronous Data Channel Module

DESCRIPTION

This Instruction Data Sheet describes the setup and installation procedures for the DA-191A Asynchronous Data Module. The DA-191A is a four-port data module, designed for use in Terminal and Drop/Insert Multiplexers. The module provides transmission of one to four asynchronous data channels over T1 or E1. The maximum data rate is 19.2 kbps for one or two channel operation, and 9.6 kbps for four channel operation. The module uses one or two time slots depending on the number and data rates of the channels being transmitted.

User-adjustable switches allow the configuration of the following parameters:
- Maximum data rate
- Single or double time slot usage
- Transmit/receive direction for drop and insert operation
- T1 or E1 (2 Mbps) system compatibility
- Time slot selection
- Data loopback for testing
- Local or remote control access
- Remote control access address

SPECIFICATIONS

As of the date this Instruction Data Sheet was published, the following specifications apply to all RFL DA-191A modules. Because all RFL products undergo constant refinement and improvement, these specifications are subject to change without notice.

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
Coding	Four three-bit transitional coders (one for each port) to minimize data jitter, with mark for idle state

Jitter	Dependent on maximum data rate selected:
	  19.2 kbps = 8 µS p-p
	   9.6 kbps = 16 µS p-p
	   4.8 kbps = 32 µS p-p

Interface	Asynchronous data interface, one-way or full duplex, one to four channel operation, four independent RS-232 data ports
Time Slots	Depending on data rates, any one time slot or any two contiguous time slots
RS-232 Interface	Supports TX Data, RX Data, Clear to Send (CTS), Carrier Detect
Indicators	LED indicators for Service On, Data In (Tx activity), and Data Out (Rx activity)
Connector	DB-9 on the Module Adapter
Operating Temperature	-20°C to +55°C Operating
Humidity	0% - 90% Non-condensing
Power Consumption	1.2 watts nominal
Dimensions	Length: 9.8 in (24.8 cm) Width: 0.6 in (1.5 cm) Height: 4.5 in (11.4 cm)
Weight	Net: 10 oz (0.28 kg) Shipping: 1 lb (0.45 kg)

INSTALLATION

Before the DA-191A module can be placed in service, it must be installed in a multiplexer shelf. Installation involves determining the module slot in the Main Shelf or Expansion Shelf where the module will be installed, inserting an I/O adapter module into the rear of the shelf behind the module slot, connecting all signal wiring to the I/O adapter module, checking the settings of all switches and jumpers, and inserting the module into the front of the shelf.

NOTE

Power supply and time slot considerations may affect the installation of RFL DA-191A modules into an existing multiplexer shelf. Refer to the portions of your multiplexer operation manual covering "Channel Module Configuration Guidelines" and "Adding More Channel Modules To Existing Systems" for more information.

The following instructions are provided for installing RFL DA-191A modules into existing systems. If the module was included as part of a system, installation was done at the factory, otherwise, proceed as follows:

1. Carefully inspect the RFL DA-191A and its I/O adapter module for shipping damage.
    If you suspect damage to the module or its Module Adapter, immediately contact RFL's Customer Service Department at the number shown at the bottom of this page.

2. Determine which module slot in the Main Shelf or Expansion Shelf the RFL DA-191A will be installed in.
    The RFL DA-191A module occupies one or two module slots in the Main Shelf or Expansion Shelf depending on the Module Adapter selected. Refer to the "as supplied" drawings furnished with the equipment for more information.

3. Determine which I/O Adapter Module will be used to make connections to the RFL DA-191A module.
    Each RFL DA-191A module installed in an IMUX 2000 multiplexer requires an I/O Adapter Module. The I/O Adapter Module provides the appropriate connections for the desired interface.

    There are three Module Adapters for the RFL DA-191A:

Module Adapter	Part Number	Interface Type	Socket	Figure
MA-420	9547-16922	2-Port RS-232	9 pin D-subminiature (DB-9)	1a
MA-440	9547-16924	4-Port RS-232	9 pin D-subminiature (DB-9)	1b
MA-425	9547-16925	2-Port RS-422	9 pin D-subminiature (DB-9)	1c

    Make sure the I/O Module Adapter you are installing is the correct one for the desired application.
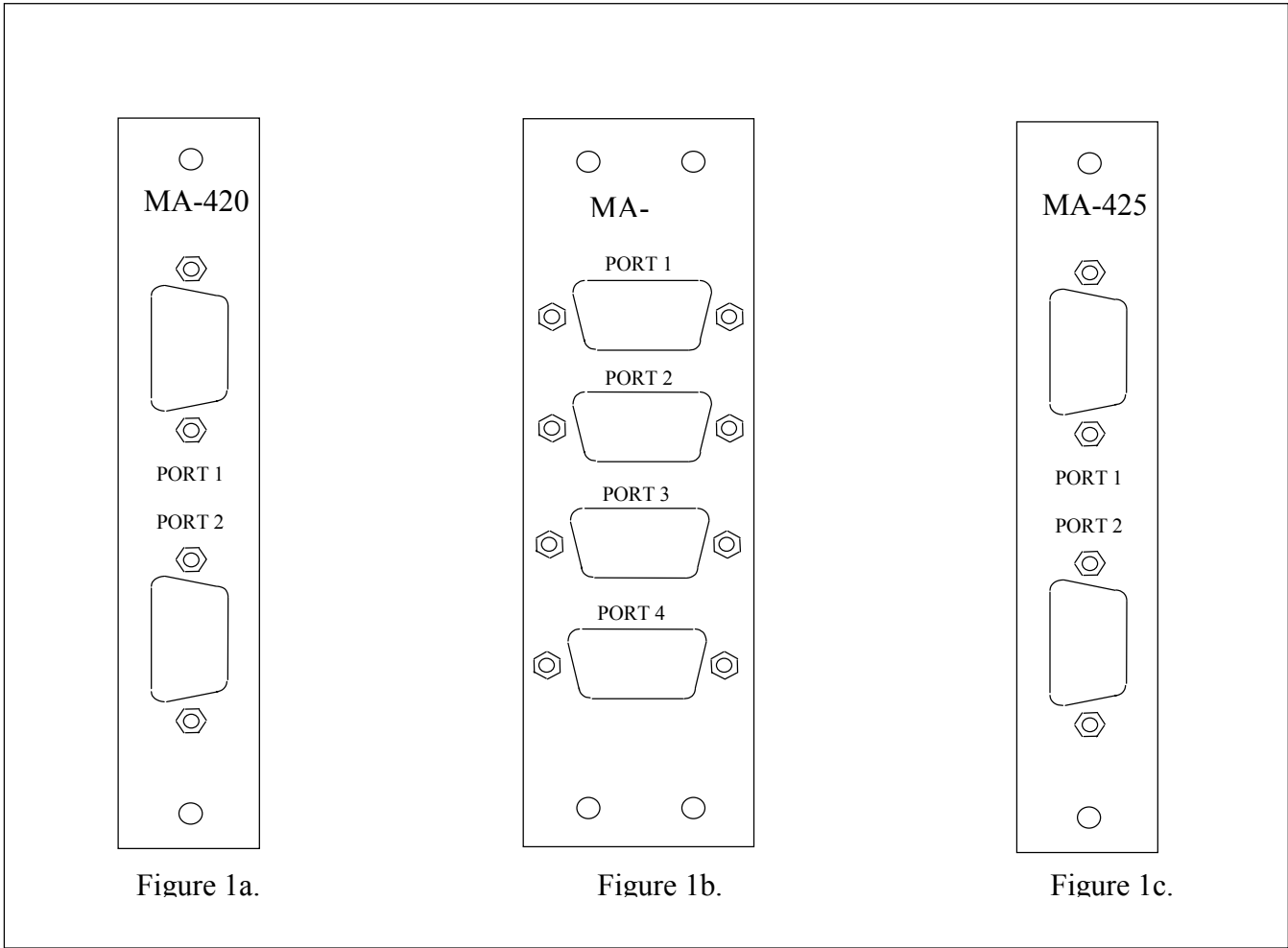
Figure 1a. Figure 1b. Figure 1c.

Figure 15 - 1 MA-420, MA-440 and MA-425 Module Adapters

Table .15.- 1 Wiring Assignments for MA-420 and 425 MA-440 Module Adapters

Pin No.	Signal Name
1	Receive Line Signal Detect
2	Receive Data
3	Transmit Data
4	Not used
5	Signal Ground
6	Not used
7	Not used
8	Clear To Send
9	Not used

Table .15.- 2. Wiring Assignments for MA- Module Adapter

Pin No.	Signal Name
1	TXA
2	TXB
3	RXA
4	RXB
5	Signal Ground
6	Not used
7	Not used
8	Not used
9	Not used

4.   Insert the Adapter Module into the rear of the shelf directly behind the module slot where the DA-191A will be installed. Secure the module with the screws provided.

5.   Connect the Adapter Module to the user equipment using the connector pin assignments detailed in Table 1.

6.   Refer to Figure 5 for the location of switches on the DA-191A

7.   On the DA-191A check the setting of DIP switch SW1-1 through SW1-3.
        SW1-1 through SW1-3 (RATE 1, RATE 0, and MODE) controls the data port configuration of the DA-191A. Set the switches to achieve the desired configuration in accordance with Table 3.

8.   On the DA-191A check the setting of DIP switch SW1-4 through SW1-8.
        SW1-4 through SW1-8 (TIME SLOT SELECT) controls the transmit and receive time slot of the DA-191A. Set the switches to achieve the desired time slot setting in accordance with Table 4.

9.   On the DA-191A check the setting of DIP switch SW2-4.
        SW2-4 (TERM) selects the DA-191A transmit bus direction. Set to the UP position to communicate via the DI-B port in a drop/insert multiplexer. Set to the DOWN position in a terminal multiplexer, or to communicate via the DI-A port in a drop/insert multiplexer.

10.   On the DA-191A check the setting of DIP switch SW2-2.
        SW2-2 (T1) selects the multiplexer type. Set UP for E1 multiplexers, or DOWN for T1 multiplexers.

11.   On the DA-191A check the setting of DIP switch SW2-1.
        SW2-1 (CAS) selects payload/CAS signaling. If this card is being installed in an E1 multiplexer, set the CAS switch to the UP position to leave time slot 16 available for payload, to the DOWN position to reserve time slot 16 for CAS signaling.

12.   On the DA-191A check the setting of DIP switch SW2-3.
        SW2-3 (LOOP) selects data loopback on or off. Verify that data loopback is turned OFF by setting the switch to the UP position.

13.   On the DA-191A check the setting of DIP switch SW3-1 through SW3-6.
        SW3-1 through SW3-6 controls the SCB address of the DA-191A. Set these switches to achieve the desired SCB address by setting in accordance with Table 7. This step is not strictly necessary unless you will be using the remote access and control feature, but it is advisable to set each card to a different address during installation in order to simplify the activation of remote operation in the future.

14.   After completing the above procedures, set the module for local control or remote control operation using the following steps.

    A.   For *local* control operation:

        1.   Set to local control: REMOTE switch (SW2-5) UP.

        2.   Turn service on: OFF switch (SW2-6) UP.

        3.   Insert the module into the selected slot in the multiplexer. The module must be inserted so that the white ejector tab is at the *bottom* in a full size (5¼" high) shelf.

    B.   For *remote* control operation:

        1.   Set to local control: REMOTE switch (SW2-5) UP.

        2.   Turn service off: OFF switch (SW2-6) DOWN.

        3.   Insert the module into the selected slot in the multiplexer. The module must be inserted so that the white ejector tab is at the *bottom* in a full size (5¼" high) shelf.

        4.   Wait 15 seconds; this loads the parameter settings for the card into the shelf common module.

        5.   Remove the module and set to remote control: REMOTE switch (SW2-5)DOWN. Do not turn service on.

        6.   Reinstall the module.

        7.   Verify the configuration via remote control by issuing a CONFIG? query. See Section on *Remote Control Interface* for an explanation of the CONFIG? response.

        8.   Set service on via remote control (SCL SET command, with "SRVC = ON" in the parameter field). You can now change the operating parameters for the module using SCL commands. For details on using the Simple Command Language (SCL) for remote access and control, consult your multiplexer operation manual.
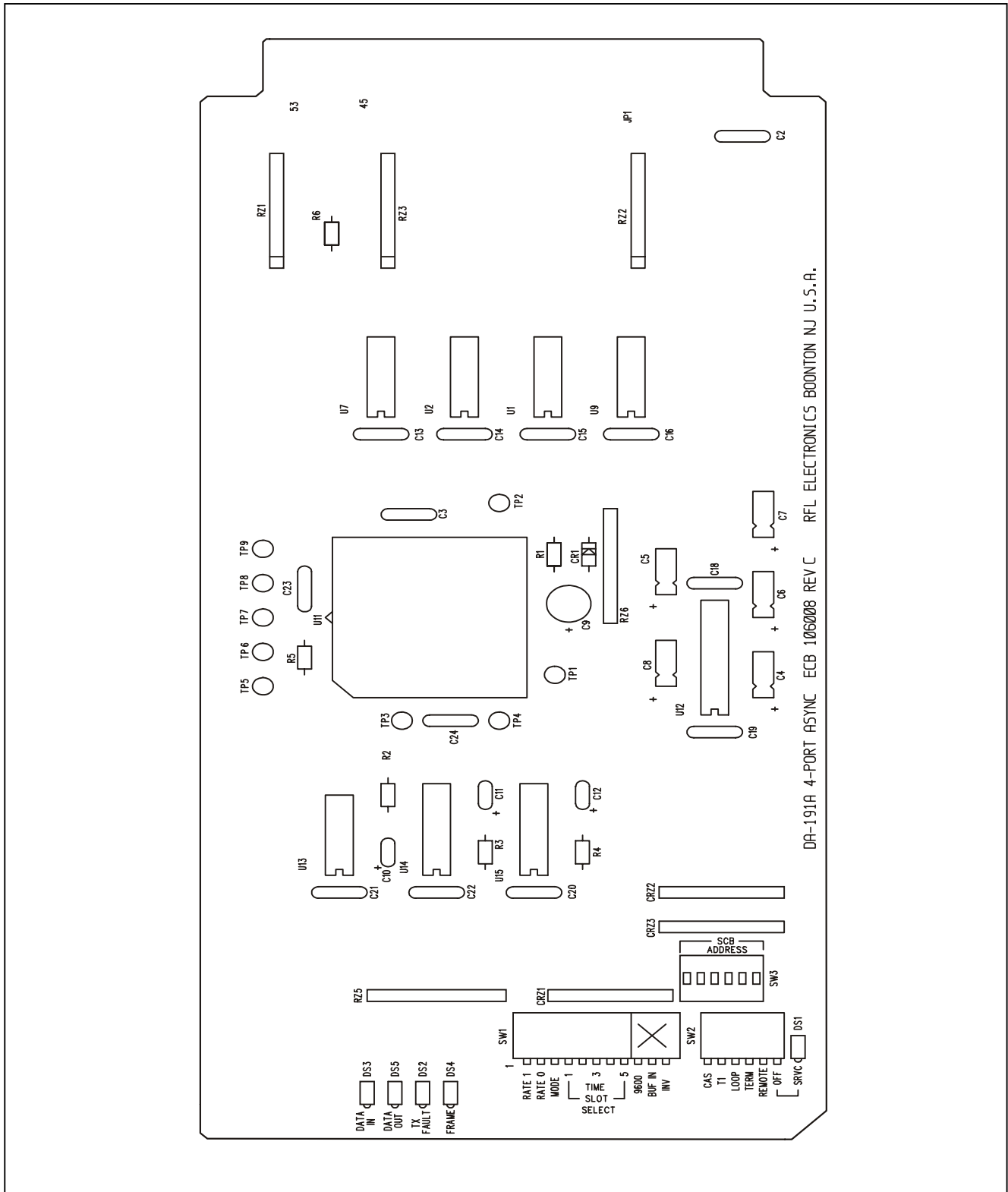
Figure 15 - 2. Controls and Indicators, RFL DA-191A Four Port Asynchronous Data Module

Table .15.- 3 Controls and indicators, DA-191A

Item	Name/Description	Function
1	LED indicator (green)	Data In: Lights when one or more channel is transmitting data.
2	LED indicator (green)	Data Out: Lights when one or more channel is receiving data.
3	LED indicator (green)	SRVC: Lights when module is active.
4	DIP Switch SW1	SW1-1 to SW1-3 Sets data port configuration, see Table 3
		SW1-4 to SW1-8 Sets time slot, see Table 4
5	DIP Switch SW2	SW2-1 Selects payload/CAS signaling UP: time slot 16 available for payload DOWN: time slot 16 available for CAS signaling
		SW2-2 Selects multiplexer type UP: E1 multiplexer DOWN: T1 multiplexer
		SW2-3 Sets loopback ON or OFF UP: Loopback OFF DOWN: Loopback ON
		SW2-4 Sets transmit bus direction UP: Operates on DI-B port in a drop/insert multiplexer DOWN: Operates on DI-A port in a drop/insert multiplexer, or Operates in a terminal multiplexer
		SW2-5 Selects Local or Remote mode UP: Local (Settings obtained from DIP switches) DOWN: Remote (Settings obtained from SCB)
		SW2-6 Sets service ON or OFF UP: Service ON (board enabled) DOWN: Service OFF (board disabled)
6	DIP Switch SW3	SW3-1 to SW3-6 Selects the SCB address, see Table 5.
7	Test point TP2	For factory use only
8	Test point TP3	For factory use only
9	Test point TP4	For factory use only
10	Test point TP5	Mode (For use with Actel Action Probe)
11	Test point TP6	Serial Data Input (For use with Actel Action Probe)
12	Test point TP7	Diagnostic Clock (For use with Actel Action Probe)
13	Test point TP8	Probe A (For use with Actel Action Probe)
14	Test point TP9	Probe B (For use with Actel Action Probe)

The two RATE switches (SW1-1 and SW1-2) set the maximum data rate for the card, and the MODE switch (SW1-3) sets the number of active time slots. These three switches work together to configure the type and number of active data ports, as shown in Table 3.

The five TIME SLOT SELECT switches determine in which time slot(s) of the T1 or E1 aggregate circuit the module places its data, as shown in Table 4.

NOTE

In an E1 multiplexer set to use CAS signaling, do not use time slot 16. If the port configuration requires two time slots, do not use either 15 & 16 or 16 & 17. If you do activate time slot 16 while CAS is on, the card will turn its service off, and it will not operate until the time slot setting is changed.

Table .15.- 4 Data Port Configuration

Switch Settings			Maximum Data Rate	Activates Port Numbers	Number Of Time Slots
SW1-1	SW1-2	SW1-3			
RATE 1	RATE 0	MODE			
DOWN	DOWN	DOWN	19.2 kbps	1	1
DOWN	DOWN	UP	19.2 kbps	1 and 2	2
DOWN	UP	DOWN	9.6 kbps	1 and 2	1
DOWN	UP	UP	9.6 kbps	1 through 4	2
UP	DOWN	DOWN	4.8 kbps	1 through 4	1

Table .15.- 5. Time Slot Selection

Time Slot(s) in a T1 Multiplexer [1]	Time Slot(s) in an E1 Multiplexer [1]	SW1-4	SW1-5	SW1-6	SW1-7	SW1-8
1 & 2		UP	UP	UP	UP	UP
2 & 3	1 & 2	UP	UP	UP	UP	DOWN
3 & 4	2 & 3	UP	UP	UP	DOWN	UP
4 & 5	3 & 4	UP	UP	UP	DOWN	DOWN
5 & 6	4 & 5	UP	UP	DOWN	UP	UP
6 & 7	5 & 6	UP	UP	DOWN	UP	DOWN
7 & 8	6 & 7	UP	UP	DOWN	DOWN	UP
8 & 9	7 & 8	UP	UP	DOWN	DOWN	DOWN
9 & 10	8 & 9	UP	DOWN	UP	UP	UP
10 & 11	9 & 10	UP	DOWN	UP	UP	DOWN
11 & 12	10 & 11	UP	DOWN	UP	DOWN	UP
12 & 13	11 & 12	UP	DOWN	UP	DOWN	DOWN
13 & 14	12 & 13	UP	DOWN	DOWN	UP	UP
14 & 15	13 & 14	UP	DOWN	DOWN	UP	DOWN
15 & 16	14 & 15	UP	DOWN	DOWN	DOWN	UP
16 & 17	15 & 16 [2]	UP	DOWN	DOWN	DOWN	DOWN
17 & 18	16 & 17 [2]	DOWN	UP	UP	UP	UP
18 & 19	17 & 18	DOWN	UP	UP	UP	DOWN
19 & 20	18 & 19	DOWN	UP	UP	DOWN	UP
20 & 21	19 & 20	DOWN	UP	UP	DOWN	DOWN
21 & 22	20 & 21	DOWN	UP	DOWN	UP	UP
22 & 23	21 & 22	DOWN	UP	DOWN	UP	DOWN
23 & 24	22 & 23	DOWN	UP	DOWN	DOWN	UP
24	23 & 24	DOWN	UP	DOWN	DOWN	DOWN
	24 & 25	DOWN	DOWN	UP	UP	UP
	25 & 26	DOWN	DOWN	UP	UP	DOWN
	26 & 27	DOWN	DOWN	UP	DOWN	UP
	27 & 28	DOWN	DOWN	UP	DOWN	DOWN
	28 & 29	DOWN	DOWN	DOWN	UP	UP
	29 & 30	DOWN	DOWN	DOWN	UP	DOWN
	30 & 31	DOWN	DOWN	DOWN	DOWN	UP
	31	DOWN	DOWN	DOWN	DOWN	DOWN

1. If the module is set to use one time slot (MODE switch down), these settings activate only for the first time slot shown.
2. Do not activate time slot 16 in an E1 multiplexer with CAS signaling turned on. The card will not operate (service will turn off).

Switch bank SW2 contains six configuration switches as listed below in Table 5.

Table .15.- 6.Configuration Switches

Switch	Function	Setting	Description
SW2-1	CAS	UP	Normal
		DOWN	Reserve time slot 16 for CAS signaling This switch is active only when the card is set to operate in an E1 multiplexer
SW2-2	T1	UP	Sets the module to operate in an E1 (2Mbps) multiplexer
		DOWN	Sets the module to operate in a T1 multiplexer
SW2-3	LOOP	UP	Normal - loopback off
		DOWN	Activates data loopback - receive data is looped back to transmit input (all channels)
SW2-4	TERM	UP	Sets the module to operate via the DI-B port in a drop/insert multiplexer
		DOWN	Sets the module to operate in a terminal multiplexer, or via the DI-A port in a drop/insert multiplexer
SW2-5	REMOTE	UP	Sets the module for local control
		DOWN	Sets the module for remote control
SW2-6	OFF	UP	Normal operation - module is active
		DOWN	Turns service off

CIRCUIT DESCRIPTION

GENERAL

Figure 4 shows a simplified block diagram of the DA-191A. A green "SRVC" LED on the front edge of the module lights when service is turned on for the module, even if no channel is actually transmitting or receiving data. The T1 switch allows the user to set the module for use in a T1 or E1 multiplexer, and the CAS switch, used in an E1 multiplexer only, determines whether time slot 16 is reserved for CAS signaling. The TERM switch determines whether the module is set up for use in a terminal multiplexer or a drop/insert multiplexer. In a drop/insert multiplexer, it also determines whether the module communicates via the DI-A port or the DI-B port. The RATE and MODE switches set the maximum data rate and whether the module uses one or two time slots. Table 6 shows the relationship between the data rate, which data ports are activated, and the number of time slots required. The TIME SLOT SELECT switches determine which time slot(s) are used.

Table .15.- 7. Data Rate and Time Slot Usage

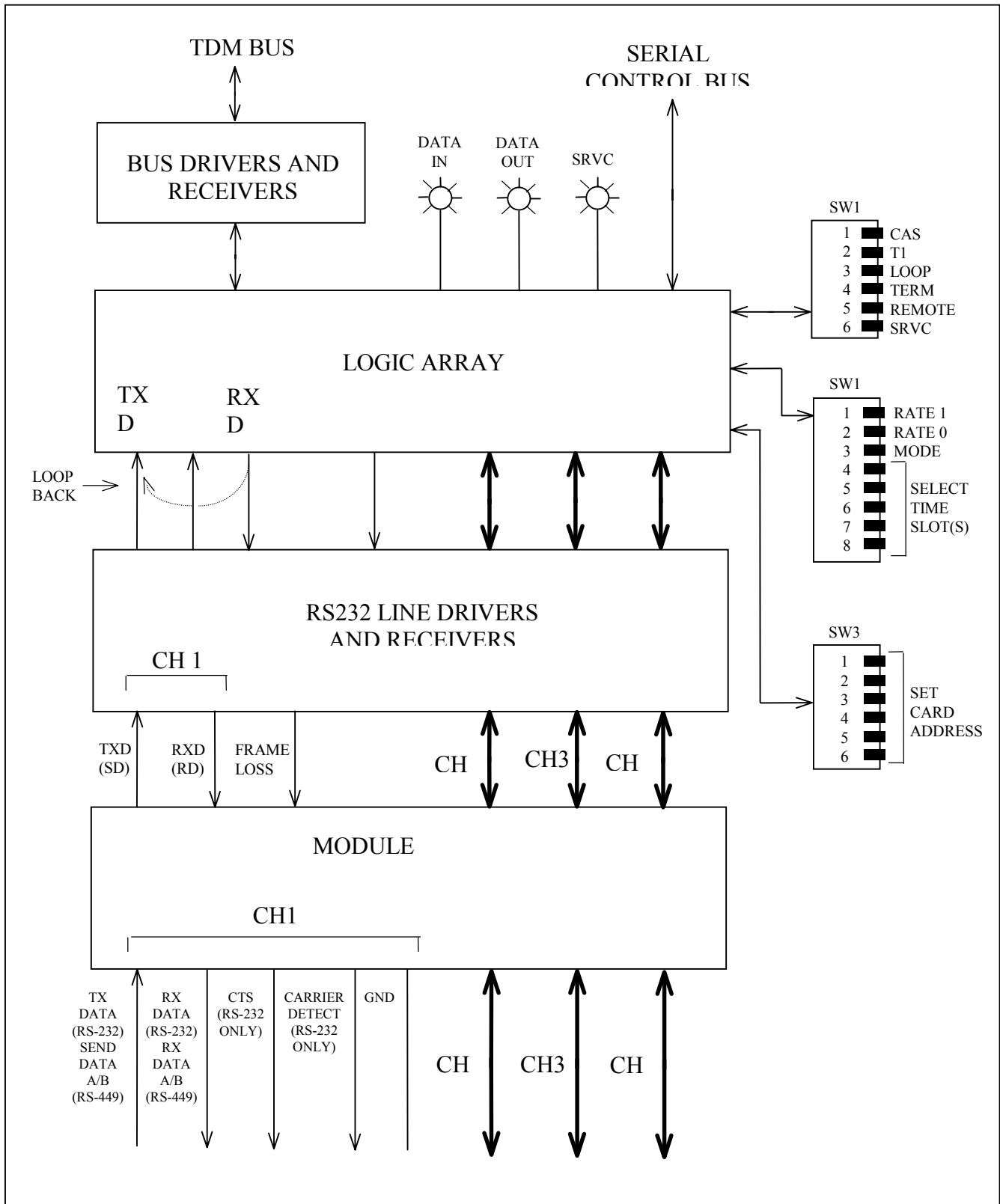| Maximum Data Rate	Active Ports	Time Slots Required
19.2 kbps	1	1
19.2 kbps	1 and 2	2
9.6 kbps	1 and 2	1
9.6 kbps	1 to 4	2
4.8 kbps	1 to 4	1

Figure 15 - 3. DA-191A Data Module, Block Diagram

TRANSMIT SIDE

The DA-191A converts asynchronous data to a format appropriate for transmission over T1, 2 Mbps, or other digital circuits made up of 64 kbps time slots. The data interface is RS-232C. The Logic Array contains four transitional coders, one for each port. When a coder detects a change in the state of the data, it generates a three-bit word containing information about that transition. The transmit data is sampled at 128 kHz for 19.2 kbps operation, 64 kHz for 9.6 kbps operation, or 32 kHz for 4.8 kbps operation. The resulting bitstream passes via the shelf backplane to the common logic module, which multiplexes the data into the aggregate signal for transmission. When used with the RS-232 module adapter, the transmit side of the module has a Clear to Send (CTS) lead for each of the four ports. This signal is always on, and cannot be controlled for RTS. A green "DATA IN" LED lights when active transmission begins on any active channel and remains lit while transmission continues.

RECEIVE SIDE

The multiplexer common module demultiplexes the aggregate receive signal and passes the data for the selected time slot to the DA-191A module. When used with the RS-232 module adapter, each port has a Carrier Detect lead which is on during normal operation. While Carrier Detect is on, the module performs transitional decoding, retimes the data, and separates the data channels if more than one data port is active. If the multiplexer loses frame synchronization, all Carrier Detect leads are turned off, and all data ports are set to MARK. Each channel then goes to an RS-232 line driver, which converts it to RS-232 level and passes it to the module adapter. On an RS-232 module adapter, the RS-232C output signal is sent to the output connector. When the LOOP switch is activated, the receive data coming out of the Logic Array is looped back to the transmit input. A green "DATA OUT" LED lights when on any active channel begins receiving data and remains lit while reception continues.

ALERTS/ALARMS

The DA-191A sends no Alert or Alarm signals to the shelf common card.

DROP AND INSERT OPERATION

A drop and insert multiplexer operates at a central point on a three (or more) site system. In the example shown in Figure 5, Site 2 has a drop and insert multiplexer whose DI-A port is connected to the transmission line to Site 1, and whose DI-B port is connected to the transmission line to Site 3. Individual payload channels may connect Sites 1 and 2, 1 and 3, or 2 and 3.

> **NOTE**
>
> **In the drop and insert multiplexer at Site 2, a DA-191A module can be set to transmit and receive either via the DI-A port (toward Site 1) or via the DI-B port (toward Site 3), but not both.**

When a DA-191A is installed in a terminal multiplexer (Site 1 or Site 3), its TERM switch must be set DOWN. However, when it is installed in a drop and insert multiplexer (Site 2), set the TERM switch DOWN to transmit and receive via the DI/A port (toward Site 1) and UP to transmit and receive via the DI/B port (toward Site 3).
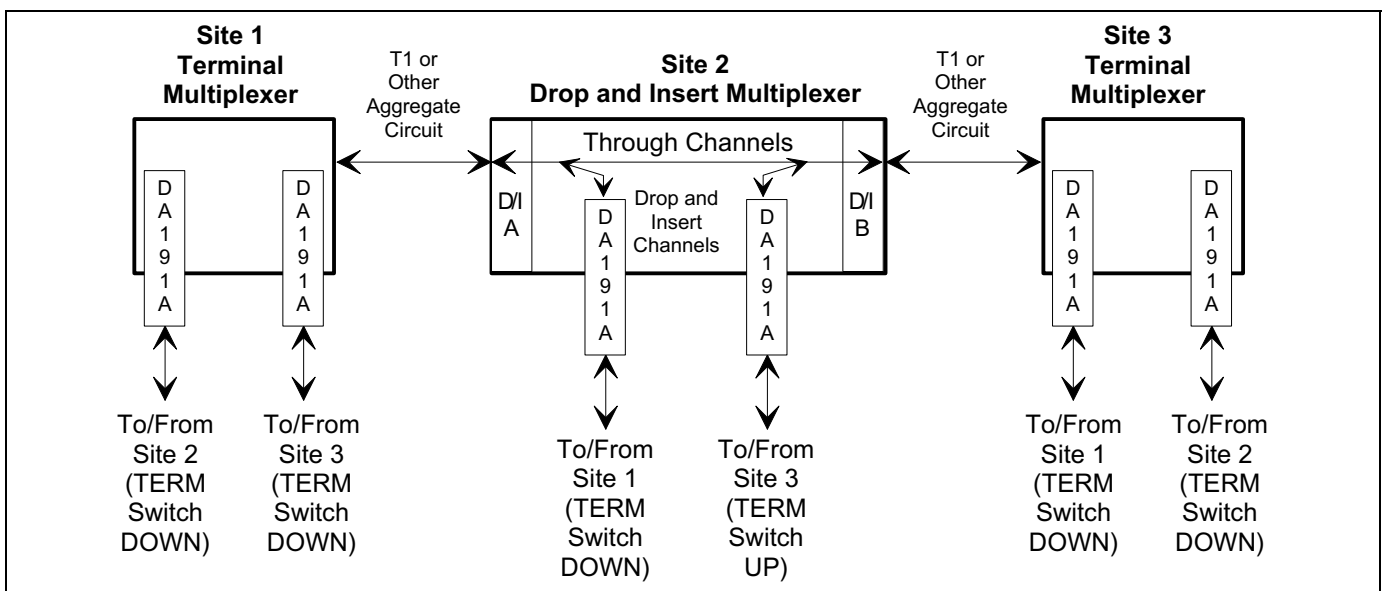

Figure 15 - 4. Example of a Three-Site System Using Drop and Insert

COMPATIBILITY WITH EARLIER DA-191 MODULE VERSIONS

The DA-191A is compatible with all earlier DA-191 and DA-191E versions, however, DA-191 and DA-191E modules can utilize only one time slot and can operate in only two modes: one channel with a maximum rate of 19.2 kbps, or two channels with a maximum rate of 9.6 kbps per channel. To establish a circuit with a DA-191A at one end and a DA-191 or DA-191E at the far end, configure the DA-191A to match the settings of the older module. In a system with two DA-191 or DA-191E modules at the far end, a single DA-191A module may be set to use two time slots and establish circuits with both of them.

REMOTE CONTROL INTERFACE

When the DA-191A module is installed in an IMUX 2000 multiplexer it can be used under local or remote control. When under remote control, certain configuration parameters can be changed only via the RS-232 remote port on the multiplexer. See the IMUX 2000 manual for information on using the remote control interface.

Before the module can receive remote commands, it must first be assigned a card address. The card address is used to route remote commands and queries to a specific module in the multiplexer. In a full size shelf, it is generally set to the physical slot number the card occupies. It may be set to any number from 1 to 36 which is not in use by another card in the same multiplexer. The card address is determined by the SCB ADDRESS switch bank (SW3) settings, as shown below in Table 7.

The remote control interface for the DA-191A involves two sets of codes: "P" (parameter) codes, and "S" (status) codes, as described in the following two sections. The DA-191A reports itself as a "TYPE 97" module.

Table .15.- 8. Card Address Settings

Card Address	Switch Settings:* SW3, Positions 1 2 3 4 5 6	Card Address	Switch Settings:* SW3, Positions 1 2 3 4 5 6
1	0 0 0 0 0 1	19	0 1 0 0 1 1
2	0 0 0 0 1 0	20	0 1 0 1 0 0
3	0 0 0 0 1 1	21	0 1 0 1 0 1
4	0 0 0 1 0 0	22	0 1 0 1 1 0
5	0 0 0 1 0 1	23	0 1 0 1 1 1
6	0 0 0 1 1 0	24	0 1 1 0 0 0
7	0 0 0 1 1 1	25	0 1 1 0 0 1
8	0 0 1 0 0 0	26	0 1 1 0 1 0
9	0 0 1 0 0 1	27	0 1 1 0 1 1
10	0 0 1 0 1 0	28	0 1 1 1 0 0
11	0 0 1 0 1 1	29	0 1 1 1 0 1
12	0 0 1 1 0 0	30	0 1 1 1 1 0
13	0 0 1 1 0 1	31	0 1 1 1 1 1
14	0 0 1 1 1 0	32	1 0 0 0 0 0
15	0 0 1 1 1 1	33	1 0 0 0 0 1
16	0 1 0 0 0 0	34	1 0 0 0 1 0
17	0 1 0 0 0 1	35	1 0 0 0 1 1
18	0 1 0 0 1 0	36	1 0 0 1 0 0

* 0 = OFF, 1 = ON

"P" CODES

"P" codes, when used in the parameter field of an SCL "SET" command, allow the user to set parameters on the DA-191A by remote control, just like setting the DIP switches on a module under local control. The two "P" codes for the DA-191A are "P1" and "P2". Each is displayed as a decimal number from 0 to 255, also represented as an eight-digit binary number (in parentheses). The binary representation is more useful for setting and interpreting the "P" codes, since each binary digit (0 or 1) corresponds to the on or off setting for a particular switch on the module. (Actually, only twelve of these sixteen digits correspond to switches; the other four are not used). Table 8 describes the meanings of the "P" codes. "P" codes also appear in the response to a CONFIG? query, showing the current parameter settings on the card. A typical DA-191A response to a CONFIG? query looks like this:

> ***OK**
> **CHANNEL CARD 3, TYPE 97**
> **UNDER REMOTE CONTROL**
> **SRVC = ON**
> **P01 = 131 (B10000011)**
> **P02 =   8 (B00001000);**

In this sample response, the "P" codes signify the following:

> P01   Module is set to operate with four active ports, maximum data rate 9.6 kbps per port, to use two time slots, #3 and #4
>
> P02   Module is set to communicate via the DI-B port in a drop/insert multiplexer, the data loopback is off, multiplexer type is E1, and CAS is off (time slot 16 not reserved)

IMPORTANT: When using binary numbers in the parameter field of a SET command, they must be preceded by the letter "B", as follows:

> <MULTIPLEXER ADDRESS>:<CARD ADDRESS>:SET:P02 = B00000011;

In addition to the P codes, it is also possible to turn service on or off for the card by sending SRVC = ON or SRVC = OFF in the ISCL parameter field with a SET command.

P Codes	Bits Used	Switch **Equivalent**	Value [1]	Description
P01	B 0 0 0 0 0 0 0 0 ↑ ↑ ↑ ↑ ↑	TIME SLOT SLECT	1 to 31	These five digits set the desired time slot(s). See Table 8 for a list of possible settings.
	B 0 0 0 0 0 0 0 0 ↑	RATE 1	1 or 0	
	B 0 0 0 0 0 0 0 0 ↑	RATE 0	1 or 0	These three digits together configure the data ports (number of active ports, data rate and time slot usage) for the module.
	B 0 0 0 0 0 0 0 0 ↑	MODE	1 or 0	See Table 9 for a list of possible settings.
P02	B 0 0 0 0 0 0 0 0 ↑	CAS	0	Normal
			1	Reserve time slot 16 for CAS signaling (in an E1 multiplexer only).
	B 0 0 0 0 0 0 0 0 ↑	T1	0	Sets the module to operate in an E1 (2Mbps) multiplexer.
			1	Sets the module to operate in a T1 multiplexer.
	B 0 0 0 0 0 0 0 0 ↑	LOOP	0	Normal - loopback off.
			1	Loopback active; receive data is looped back to transmirt input (all channels).
	B 0 0 0 0 0 0 0 0 ↑	TERM	0	Sets the module to operate via the DI-B port in a drop/insert multiplexer.
			1	Sets the module to operate in a terminal multiplexer, or via the DI-A port in a drop/insert multiplexer.
	B 0 0 0 0 0 0 0 0 ↑ ↑ ↑ ↑		0	Not used.

1. These are the only legal values for setting the parameters. Setting any parameter to a value outside its specified range will produce an unpredictable result.

Table .15.- 10Time Slot Selection Via Remote Access

Active [1] Time Slot (s)	P1 Settings for Time Slot Select
1 & 2	Bxxx00001
2 & 3	Bxxx00010
3 & 4	Bxxx00011
4 & 5	Bxxx00100
5 & 6	Bxxx00101
6 & 7	Bxxx00110
7 & 8	Bxxx00111
8 & 9	Bxxx01000
9 & 10	Bxxx01001
10 & 11	Bxxx01010
11 & 12	Bxxx01011
12 & 13	Bxxx01100
13 & 14	Bxxx01101
14 & 15	Bxxx01110
15 & 16 [2]	Bxxx01111
16 & 17 [2]	Bxxx10000
17 & 18	Bxxx10001
18 & 19	Bxxx10010
19 & 20	Bxxx10011
20 & 21	Bxxx10100
21 & 22	Bxxx10101
22 & 23	Bxxx10110
23 & 24	Bxxx10111
24 & 25	Bxxx11000
25 & 26	Bxxx11001
26 & 27	Bxxx11010
27 & 28	Bxxx11011
28 & 29	Bxxx11100
29 & 30	Bxxx11101
30 & 31	Bxxx11110
31	Bxxx11111

1. If the module is set to use one time slot (**MODE** = 1), these codes activate only the *first* time slot shown.
2. Do not activate time slot 16 in an E1 multiplexer with CAS signaling turned on. The card will not operate (service will turn off).

Table .15.- 11. Data Port Configuration Via Remote Access

P1 Settings for Mode, Rate 0, and Rate 1	Maximum Data Rate	Activates Port Numbers	No. Of Time Slots
B111xxxxx	19.2 kbps	1	1
B011xxxxx	19.2 kbps	1 and 2	2
B101xxxxx	9.6 kbps	1 and 2	1
B001xxxxx	9.6 kbps	1 to 4	2
B110xxxxx	4.8 kbps	1 to 4	1

"S" CODES

There is only one "S" code for the DA-191A module. It appears in response to a STATUS? query, and indicates the presence or absence of transmit and receive activity, as shown in Table 11. Like the "P" codes, the "S" code is displayed in both decimal and binary form. A typical response to a STATUS? query looks like this:

> ***OK**
> **CHANNEL CARD 3, TYPE 97**
> **S01 = 0 (B00000011);**

In this sample response, the "S" code indicates that both transmit and receive activity is present.

Table .15.- 12. Remote Status Queries (S Codes)

S Code	Bits Used	Value	LED Equivalent	Description
S01	B 0 0 0 0 0 0 0 0 ↑	0		No receive activity detected
		1	DATA OUT	Receive activity detected on one or more data channels
	B 0 0 0 0 0 0 0 0 ↑	0		No transmit activity detected
		1	DATA IN	Transmit activity detected on one or more data channels
	B 0 0 0 0 0 0 0 0 ↑ ↑ ↑ ↑ ↑ ↑			Not used

TESTING

When the DA-191A Data Module has been configured and installed, test it for proper operation before putting it into service. There are two ways you can do the testing:

1. Local testing using the multiplexer equipment loopback, with the system out of service.

2. End-to-end testing using far end module data loopback, with the system in service but the channel being tested out of service.

Use the following procedure to test the modules:
1. For local testing, activate the multiplexer equipment loopback following the instructions in your multiplexer operation manual.

    For end-to-end testing, set the loopback (LOOP) switch on the far end DA-191A module ON, and set the multiplexer at one end of the circuit to use loop timing.
2. Connect a data error analyzer (Telecommunication Techniques Corp. Fireberd 2000 or equivalent) to the jack for channel one on the back of the module adapter, using a DB-9 cable.
3. Check for synchronization on the output signal.
4. Send single errors on the transmit side and check for single errors on the receive side.
5. Run for 30 seconds and confirm that the signal remains error-free.
6. Repeat test on each channel set up for use in the current configuration.
7. If you used end-to-end testing, return the LOOP switch at far end to OFF position. The system is now operational.

If there is an apparent malfunction during end to end testing, first check that the configuration at the two ends is identical.

Most problems occur at the common equipment or facility level. Refer to the *Troubleshooting* section in your multiplexer operation manual for system analysis procedures.