TC1720

RS-422/RS-449 Async/Sync
FIBER OPTIC MODEM
(with Optional Dual Optics)

User's Manual

MODEL: _____

S/N: _____

DATE: _____

Notice!

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TC COMMUNICATIONS
FIBER OPTIC CONNECTIVITY

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Chapter 1 - Overview

Description

The TC1720 RS-422/RS-449 is an economical and dependable fiber optic modem which links data communication equipment requiring an RS-422A interface. It supports Asynchronous data speeds of up to 10 Mbps & Synchronous data speeds of up to 5 Mbps and is equipped with a male DB37 connector. A four-position DIP switch provides for Remote & Local Loopback functions, Slave Clock operation & Alarm disabling capability.

It is available in either rack mount or stand alone versions; the rack mount version can be converted to the stand alone version with the addition of a sheet metal box. The TC1720 can communicate at distances up to 4 km using Multimode optics and up to 80 km using Single Mode optics. Fiber optic connectors can be either ST or FC type. TC1720's design utilizes advanced FPGA (Field Programmable Gate Array) technology to increase reliability and flexibility.

The TC1720 has multiple LED indicators to ease installation and troubleshooting. These LEDs indicate status for power, operating voltage, alarm, transmit & receive electrical signals, optical signal and more.

Electrical Specifications

Interface: **RS-422/RS-449 Async/Sync**
Data Rates: **Async Up to 10 Mbps**
Sync Up to 5 Mbps
Connector: **DB37 Male (DCE/DTE switch selectable)**

Virtual Pin Assignments & Theory of Operation

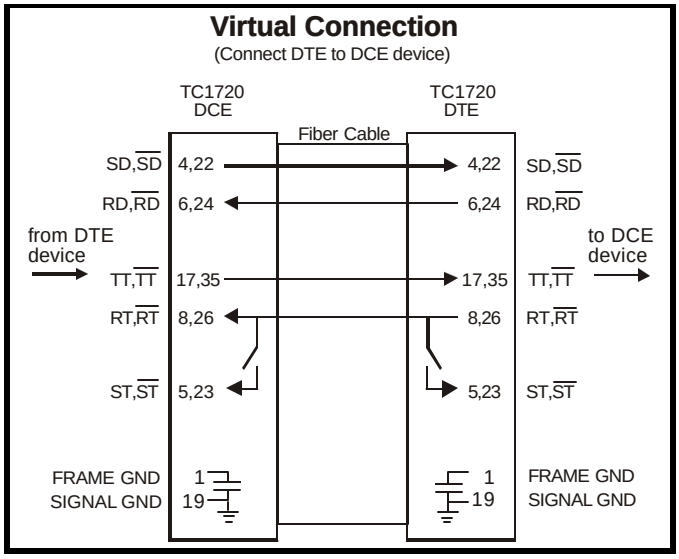


Figure 1. Connecting a DTE to DCE Device Logic Diagram

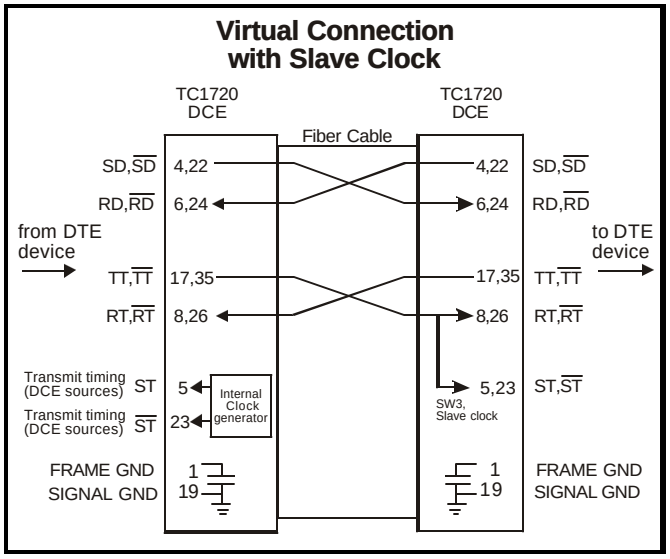
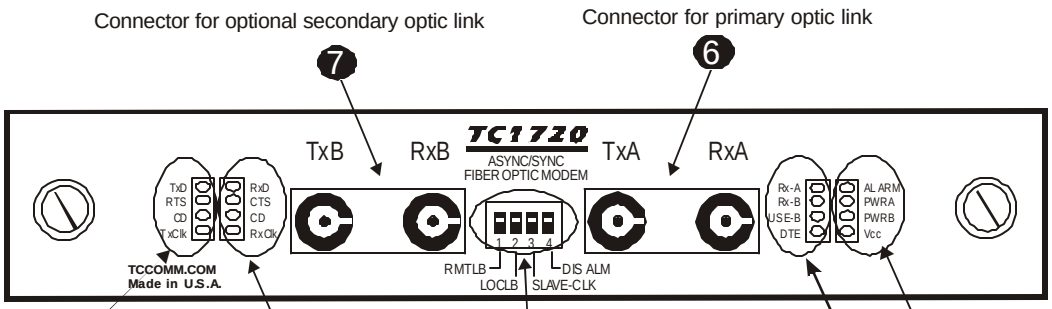


Figure 2. Connecting a DTE to DTE Device Logic Diagram

The TC1720 latches onto the RS-422/RS-449 data by the received clock signal (from user's equipment or the internal clock generator from the TC1720) to produce an encoded optic signal (with an embedded clock). The composite optic signal is then transmitted by the optic transmitter through the optic cable to a remote TC1720's optic receiver. The received optic signal is processed and decoded to separate data and clock from the composite optic signal and then transmitted out to a remote device.



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status for received electrical signals
(from remote unit):
RD- "received data" ("TD")
CTS- "clear to send"("RTS"
CD- "carrier detect" ("CD")
RCLK- "received clock" ("TxClk")

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Status for electrical signal from
local user's device:
TxD- "transmit data"
RTS- "request to send"
CD- "carrier detect"
TxClk- "transmit clock"

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Switches to initiate ("down" position)
following tests and function:
RMTLB- turn on remote unit's loopback
LOCLB- turn on local electrical interface's loopback
SLAVE-CLK - Turns on Slave Clock mode: (RT=ST)
DISALM- disable alarm buzzer and relay

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Alarm Indicator, Power Status &
Operating Voltage Status
Alarm (red):
off - normal operation
solid- major alarm condition (optic input lost)
flash- remote loopback activated by remote unit
PWR A: DC power supply from PWR A jack
PWR B: DC power supply from PWR B jack
Vcc: +5 VDC operating voltage power supply

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received optic signal status
& DTE indicator
RxA:
- Solidly lit, when optic signal is received "OK" from primary side ("A" side)
- Flashing, when optic signal lost

RxB:
- Solidly lit, optic received "OK" from secondary side ("B" side)
- Flashing, when optic signal lost or "B" side is not enabled

USE-B:
- Solidly lit, when secondary optic signal is being used due to primary optic signal lost
- Off, secondary optic receiver is not enabled or primary optic signal is being used.

DTE:
- Solidly lit, when unit is configured as DTE.
- Off, when unit is configured as DCE.

NOTE:
SLAVE-CLK Switch 3: - DTE it is not used.
- DCE when it is "on" (down position), it turns "on" the Slave-clock mode: (RT=ST).
when it is "off" (up position), it turns "on" the Internal clock mode: (ST=Internal clock) see table 1.

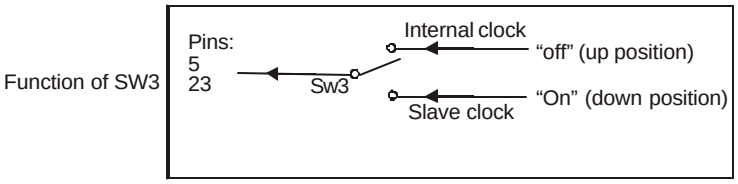


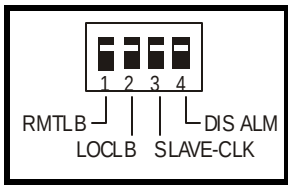
Figure 3. TC1720's Front Panel

DIP Switch Functions

For troubleshooting purpose, user can conduct remote loopback and local loopback test. TC1720 also has a built-in signal generator for user to validate fiber optic link. There are two groups of DIP switches: one at the front panel, the other one is located at the center of the PC board.

Front Panel Switches

There are four DIP switches located at the front panel. Usually, they are very useful during installation or troubleshooting. They are described as follows:



DIP #1: Remote loop back. This switch (DIP #1) initiates the Remote loop back function. The composite optic signal is received from optic "RxA" and decoded, then looped back to optic "TxA."

DIP #2: Local loop back (for diagnostic use). When DIP #2 is pressed down, an electrical signal loop is created, the input electrical signal is converted to the TTL level and looped back.

DIP #3: Internal clock generator "off" when DIP #3 is in the up(off) position. When switched to the down ("on") position, the received clock signal (from the remote side) is also used as an internal clock signal and is transmitted to the user's equipment.

DIP #4: Disable dry contact alarm.

These functions can be initiated from one of four DIP switches accessible from front panel. Under normal operation, all the switches should be set in "UP" position.

SW1 Internal PCB Dip Switches

There are other eight DIP switches located at the PC board and can not be accessed from front panel. These switches are usually only used during installation.

SW1-1: Enable signal generators. This switch initiates the built-in Signal Generator function. The unit will generate a visual signal to verify optic link.

SW1-2: Configure TC1720's interface as a DCE or DTE. **Off**: DCE **On**: DTE

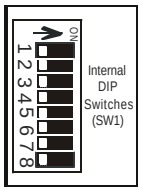
SW1-3: Enable RxB. (On dual fiber optic models only)

SW1-4: Async/Sync. Configure unit as Async or Sync. **On**: Async **Off**: Sync

Note: DIP Switches SW1-5 through SW1-8 are used for the internal clock generator. If the internal clock from the TC1720 will be utilized, a clock rate can be selected according to the following table.

For Oscillator: 8.192Mhz

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SW1-5:		x		x		x		x		x		x		x		x
SW1-6:			x	x			x	x			x	x			x	x
SW1-7:					x	x	x	x					x	x	x	x
SW1-8:									x	x	x	x	x	x	x	x
		8k	9.6k	16k	19.2k	32k	38.4k	56k	64k	128k	256k	512k	1.024M	2.048M	4.096M	5 - 10M



Legend: **X = ON**

This table shows the Internal Clock speed when the TC1720 is DCE, on DB37 pin 5 & 23.

Table 1. TC1720 Internal Clock Settings (Internal SW1)

RS-422/449 Termination Resistor

A termination resistor is usually necessary for RS-422 applications. Without proper termination, the error rate of data transmission may be high due to an "echo" effect on the electrical connection. With the addition of a termination resistor at the beginning or end of the electrical bus, this echo effect is greatly reduced. The termination resistors are 100 to 130 ohm resistors located inside the TC1720. Two jumpers, identified as board locations "JP2" & "JP3," control the termination resistance on each unit. "JP3" controls the resistance for the unit's receiver, while "JP2" controls the transmitter's resistance. Proper line termination is usually accomplished by leaving the "JP3" jumper intact at both ends of the link.

Optical Specifications

The following measurements are based on Async data rates of up to 10Mbps.

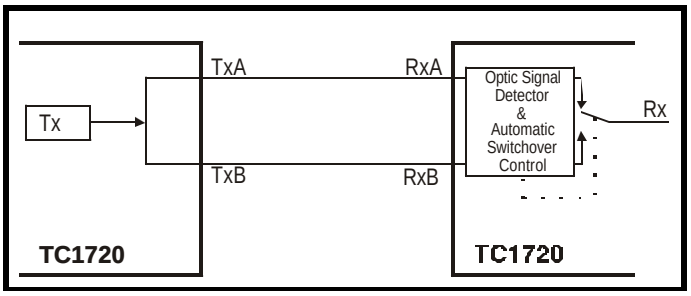
Transmitter:	**LED/ELED; typical Launch Power:**	**-19dBm* (1310nm Multimode, @62.5/125µm)**
		-16dBm* (1310/1550nm Single Mode, @9/125µm)
Receiver:	**PIN Diode; typical Sensitivity:**	**-34dBm* (1310nm Multimode, @62.5/125µm)**
		-36dBm* (1310/1550nm Single Mode, @9/125µm)
Loss Budget:	**1310nm MM, @62.5/125µm:**	**15dB**
	1310/1550nm SM, @9/125µm:	**20dB**
Distance:	**1310nm Multimode, @62.5/125µm:**	**up to 4km distance***
	1310nm Single Mode, @9/125µm:	**up to 50km distance***
	1550nm Single Mode, @9/125µm:	**up to 80km distance***

Launch power, sensitivity and distance are listed for reference only. These numbers may vary.

Optical Redundancy (optional)

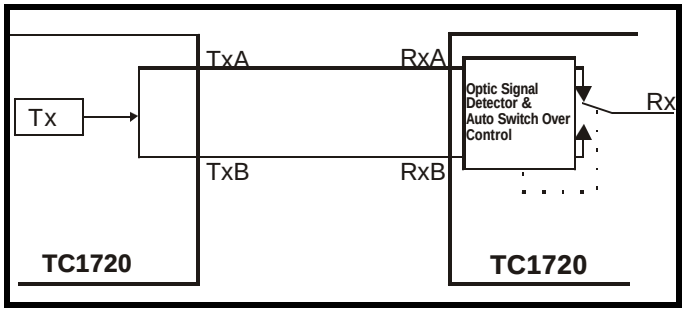
If optic redundancy was ordered with the unit, figure below applies to its operation. Optic redundancy is used to prevent the loss of data transmission in the event an optic cable, transmitter, or receiver is broken or degraded. Should this occur, the secondary optic link & receiver "B" is enabled automatically, thereby preserving the integrity of the communication. In the meantime, the "Alarm" LED will flash and the buzzer will sound to indicate a cable breakage.

When the unit is equipped with optic redundancy, the optic transmitter "TxA" and "TxB" both transmit the same signal to the remote unit. It is up to the remote unit to decide whether "RxA" or "RxB" should be used as the valid incoming optic signal. By default, "RxA" is the primary receiver; "RxB" is the stand by backup.



Dry Contact Alarm Relay

A terminal block connector at the rear panel provides for the Dry Contact Alarm Relay. Normally in the OPEN position, any alarm condition will force the switch to a CLOSED position. This relay can be used in conjunction with an external device to signal an alarm condition.



Power Supply and Rear Panel

The TC1720 consumes very low power. The standard input voltage is from 12VDC and current is 500mA (max). You may use an external power adapter with the following specifications: 12V DC @800mA (positive polarity at the left terminal when viewed from the rear panel).

The power plug can be connected into either power jack on the rear panel. Because the TC1720 is equipped with a built-in power redundancy feature, the "POWER A" or "POWER B" LEDs on the front panel will illuminate according to which power source the unit is drawing from. If power redundancy is utilized, both LEDs will light.

For units with the -48V DC power supply option, a DC-to-DC converter is installed inside the unit. The DC current requirement for the optional -48V DC power supply is @50mA.

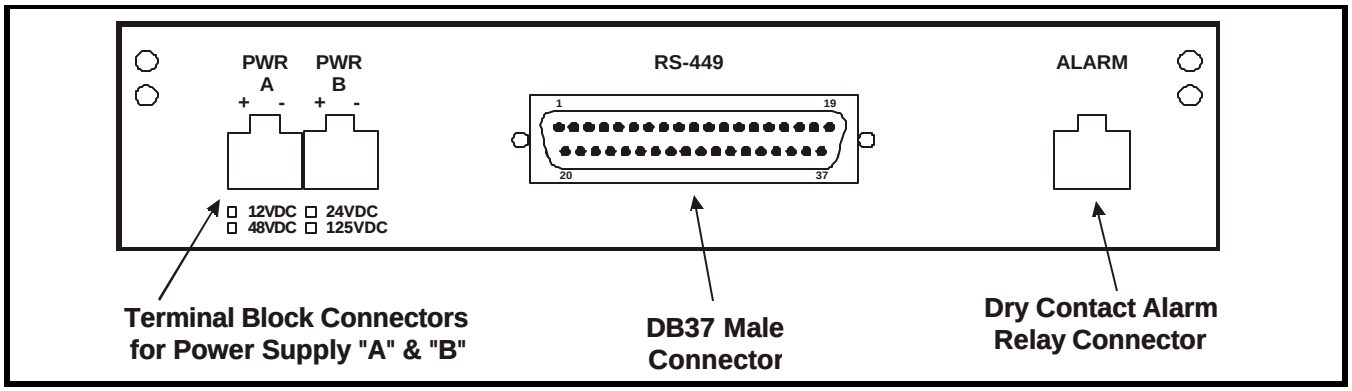


Figure 4. TC1720's Rear Panel

Chapter 2 - Installation

Unpacking the Unit

Before unpacking any equipment, inspect all shipping containers for evidence of external damage caused during transportation. The equipment should also be inspected for damage after it is removed from the container(s). Claims concerning shipping damage should be made directly to the pertinent shipping agencies. Any discrepancies should be reported immediately to the Customer Service Department at TC Communications, Inc.

Equipment Location

The TC1720 should be located in an area that provides adequate light, work space, and ventilation. Avoid locating it next to any equipment that may produce electrical interference or strong magnetic fields, such as elevator shafts, heavy duty power supplies, etc. As with any electronic equipment, keep the unit from excessive moisture, heat, vibration, metallic particles and freezing temperatures. Installation Procedure Summary

Installation Procedure Summary

The TC1720 is designed for quick and easy installation. Before installing, however, make sure all DIP switches are in the up ("Off") position and double-check the polarity at the DC power's terminal block connector. The installation procedure is as follows:

1. **Connect your DTE/DCE Device to the DB37 Connector:** Check the Pin Assignments on page 3 and verify your application's data rate. Shielded cable is recommended.
2. **Connect the optic cables:** Connect the local unit's optic "TxA" to the remote unit's optic "RxA". Connect the local unit's optic "RxA" to the remote unit's optic "TxA." (do the same for "TxB" and "RxB" on Dual Optics Models).
3. **Connect the power plug:** The plug can be connected into either power terminal "A" or "B" (check for proper polarity). The unit is equipped with power redundancy. By plugging a second power supply to the spare power terminal, power redundancy is enabled. Verify that the power "A" and/or "B" LED is illuminated.
4. **Turn "On" your device:** If your device is a DTE/DCE device, the "TxD" & "TxClk" LEDs on the local unit should be illuminated, meaning the signal is being transmitted. On the remote unit, the "RxD" & "RxClk" LEDs should be illuminated, meaning the signal is being received.
5. **Check the "Rx-A" LEDs:** When a good optic signal is received, the "Rx-A" LED on the corresponding unit should illuminate. (Check "Rx-B" LED when "Optic TxB" and "Optic RxB" are in use. Dual Optics model only).

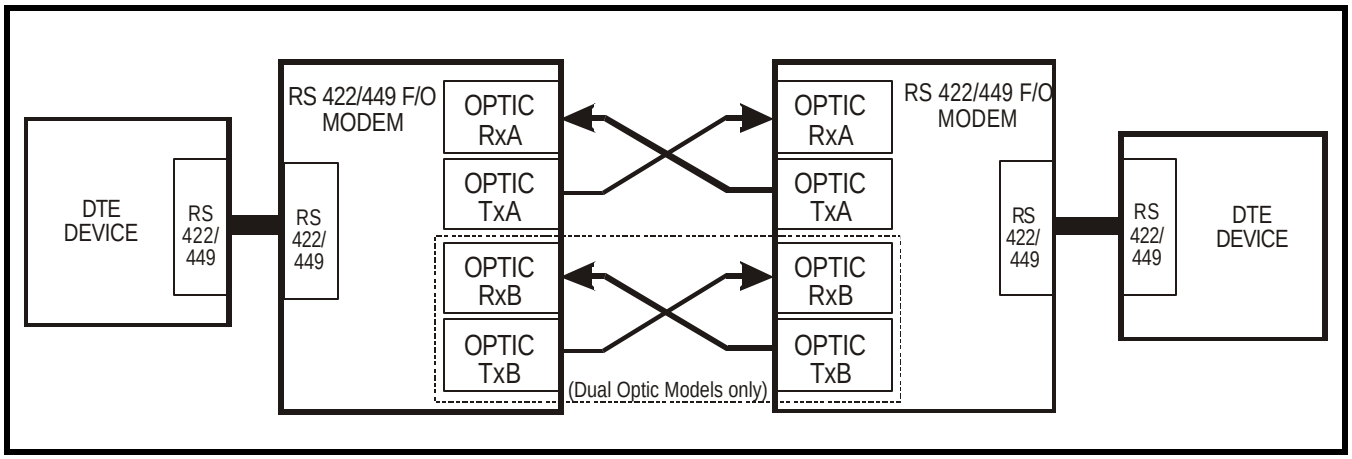


Figure 5. Typical Point-to-Point RS-442/449 Application Diagram

After installation is complete, it is an excellent idea to verify and record the optical cable loss. This reading will both verify the integrity of the system and provide a benchmark for future troubleshooting efforts (see Chapter 3 - Troubleshooting).

Chapter 3 - Troubleshooting

General

Typically, most problems encountered during installation are related to an improperly wired RS-442/449 cable or a break in the integrity of the fiber optic link (cable or connectors).

All LEDs are "Off"

If no LEDs are lit on the unit, check the DC power supply, terminal block connector plug, and/or power source. If the problem persists, contact the Technical Support Department at TC Communications, Inc.

Alarm LED

When there is an alarm condition, the red "ALARM" LED will be lit and the "RxA" LED will also flash to indicate the optic signal has been lost. The Alarm will also trigger the dry contact relay switch.

Optic Cable Types

Conventionally, fiber optic cable with yellow-colored insulation is used for single mode applications; gray or orange-colored insulated cable is for multimode use. If multimode cable is used in a single mode application, the test results could be erroneous and confusing.

Calculating the Loss on the Fiber

The fiber optic link and/or the connectors are frequently the source of communication problems. If problems are present, check the optic connectors and the integrity of the link first. Ideally, the link should be calibrated for total loss after the installation has been completed. This will accomplish two things: (1) it will verify that the total loss of the link is within the loss budget of the device and (2) it will provide a benchmark for future testing. For example, a system that has been tested as having 6dB of signal loss when installed should not suddenly test out as having a loss of 10dB. If this were the case, however, the fiber link or connector would probably be the source of the problem.

These are the reference values we use to calculate the loss on the fiber:

Multimode 1310nm	**:**	**2 dB loss per km on 62.5/125µm cable***
Single Mode 1310nm	**:**	**0.5 dB loss per km on 9/125µm cable***
Single Mode 1550nm	**:**	**0.25 dB loss per km on 9/125µm cable***

These numbers are listed for reference only. We recommend an OTDR reading be used to measure actual link loss.

RS-442/449 Cable Verification

1. Make sure the electrical signal connections match the pin assignments for the device (refer to page 3 for DCE/DTE pin connections). Verify signal connections by checking the status LEDs on the front panel of the TC1720. Verify that the pin signal connections match the appropriate LED responses (see Figures 1, 2 & 3).

2. Be sure that all switches are set correctly. All the front panel DIP switches should be in up (off) position. All the "SW1 Internal DIP Switches" are generally factory configured. However, the clock settings can be user configured with SW1-5, SW1-6, SW1-7, and SW1-8, to suit the user's timing needs, refer to table 1 on page 5.

Important Warranty Note:

If the need arises for any internal configuration, please contact the Technical Support Department at TC Communications, Inc @ (949) 852-1973. Warranty voided if product seal is broken.

Optic Cable Verification

If the "Rx-A" LED on the front panel is flashing (or off), this is an indication that the optic signal is not being correctly received. Usually, unsecured fiber optic connectors or faulty cable are to blame. A good connection is indicated by the "Rx-A" LED on the front panel being solidly lit. This indicates that the receiving cable is correctly connected to the remote unit's optic "TxA."

On Dual Optics Models, the same applies to "RxB" and "TxB." Dual Optics Models will automatically switch to optic "RxB" if optic "RxA" is not receiving a valid signal. This automatic switchover enables the user to verify the "B" fiber connection by simply disconnecting the "A" fiber connection, thereby verifying the optical redundancy capability of the unit. (Dual Optics is an optional feature).

Chapter 4 - Bench Tests

General

It is highly recommended to conduct a bench test before actual installation. A bench test will allow the user to get familiar with all the functions and features of the TC1720 in a controlled environment. Knowledge of the TC1720's functions and features will facilitate installation and troubleshooting efforts later on.

Test Equipment Requirements

End user equipment required for testing:

1. One BERT (Bit Error Rate Tester) test set with a DB37 Female adapter and appropriate interface module (match pin assignments with the diagrams on page 3).
2. Two short optical cable jumpers with appropriate connectors (ST or FC).

Pre-Installation Tests

1. Make sure the appropriate power supply accompanies the TC1720 unit (see page 7).
2. To verify that the unit functions properly, plug in only the power connector to the terminal (be sure to observe correct polarity), without having any other cable connections to the unit.
3. On the front panel, the appropriate green "Power A" or "Power B" LED should be illuminated (depending on whether you plug into the "A" or "B" terminal on the back of the unit). Both lights should be on if you utilize power redundancy (power is connected to both "A" and "B" terminals on the rear panel).
4. The "ALARM" and "Rx-A" LEDs should be flashing.
5. The "Vcc" LED should be illuminated. Please note: all other LEDs can be in a random state (flashing, solidly lit, or off) as only upon proper receipt and transmission of a signal will the TC1720 set its LEDs appropriately for normal operation.

Local Electrical Loopback Test

1. Set up the bench test as illustrated in Figure 6 below.
2. Make sure your BERT tester is turned on and configured as an RS-422/499 DTE device if the unit is DCE.
3. Connect the DB37 female adapter (check pin assignments on page 3) from the BERT tester to the TC1720's DB37 male connector (on the rear panel).
4. Set the BERT test set to the same (or as close to the same) data rate as the application you plan to connect to (typically 19.2Kbps through 128Kbps Synchronous).
5. The data bits should be selected as '8 bits' and the data pattern should be set to '2047' on the BERT tester.
6. At this point, the following LEDs should be observed on the TC1720 unit: The "TxD," "TxClk," "PWRA or PWRB," "Vcc," and "ALARM" should be solidly lit. Note, the "ALM" LED will be solidly lit and the "RxA" LED will be flashing since there is no optical fiber cables connected. All other LEDs should be off.
7. Now, turn the front panel SW2-2 (LOCLB) dip switch to the down "On" position to enable the Local Loopback test function.
8. At this point, the tester should indicate a Synchronous signal being received indicating that the RS-422/449 electrical signal is transmitted and received okay.
9. Verify that the "TxD," "RxD," "TxClk," "RxClk," "ALARM," "PWRA or PWRB," and "Vcc" LEDs are solidly lit. Note, the "ALM" LED will be solidly lit and the "RxA" LED will be flashing since there is no optical fiber cables connected. All other LEDs should be off.

   You should not see any bit errors. To verify this, inject an error using the BERT tester to see if it will be recorded by the tester, then verify that no additional errors appear after the user injected error.
10. When done with this test, make sure to return the front panel SW2-2 (LOCLB) dip switch to the up "Off" position to disable the Local Loopback test function and proceed with other tests.

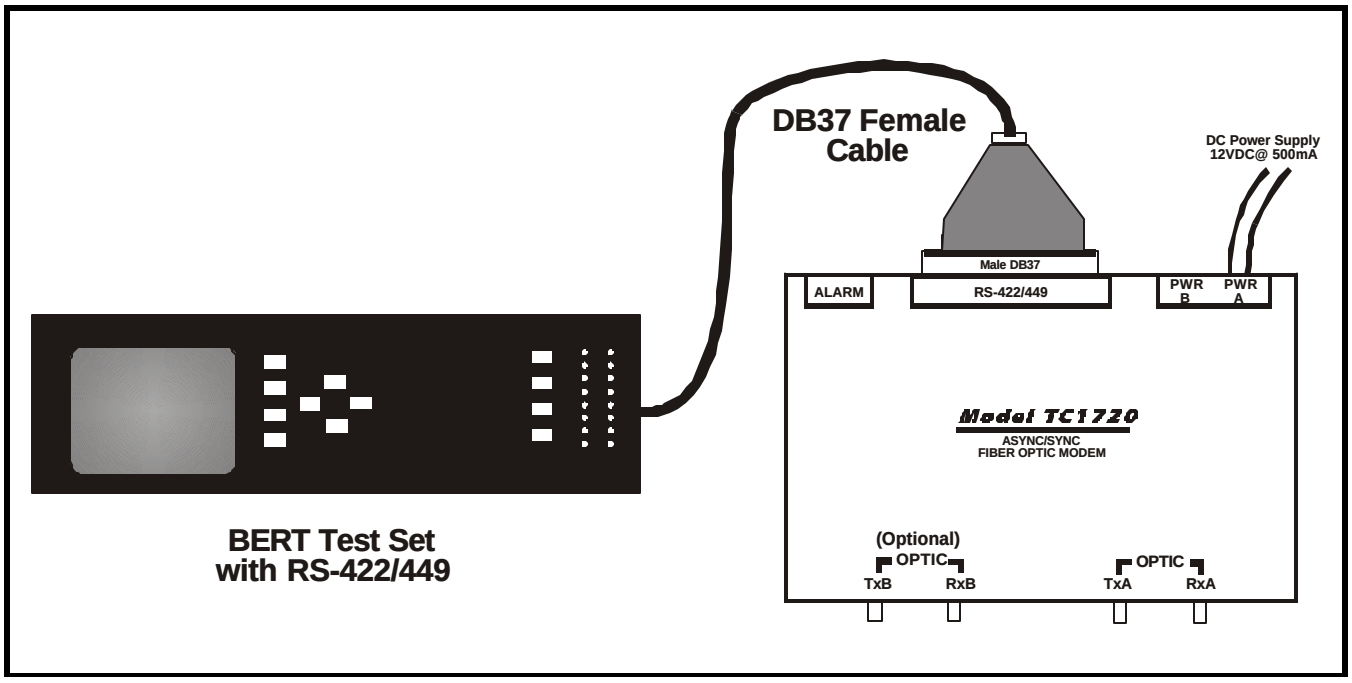


Figure 6. Local Electrical Loopback Test Connection Diagram

Local Optical Loopback Test

To perform this local optical test, all the front panel SW2 dip switches should be to the up "Off" position.

1. Set up the bench test as illustrated in Figure 7 below. Make sure to use the correct type of fiber optical jumper cables (either Single Mode or Multimode according to the specifications of the TC1720s).
2. Make sure your BERT tester is turned on and configured as an RS-422/499 DTE device if the unit is DCE.
3. Connect the DB37 female adapter (check pin assignments on page 3) from the BERT tester to the TC1720's DB37 male connector (on the rear panel).
4. Set the BERT test set to the same (or as close to the same) data rate as the application you plan to connect to (typically 19.2Kbps through 128Kbps Synchronous).
5. The data bits should be selected as '8 bits' and the data pattern should be set to '2047' on the BERT tester.
6. At this point, the tester should indicate a Synchronous signal being received indicating that the RS-422/449 electrical signal is transmitted and received okay.
7. Verify that the "TxD," "RxD," "TxClk," "RxClk," "RxA," "PWRA or PWRB," and "Vcc" LEDs are solidly lit on the TC1720. Note, the "ALARM" LED will be "Off" since there is optical fiber cable(s) connected. All other LEDs should be off.

   You should not see any bit errors. To verify this, inject an error using the BERT tester to see if it will be recorded by the tester, then verify that no additional errors appear after the user injected error.

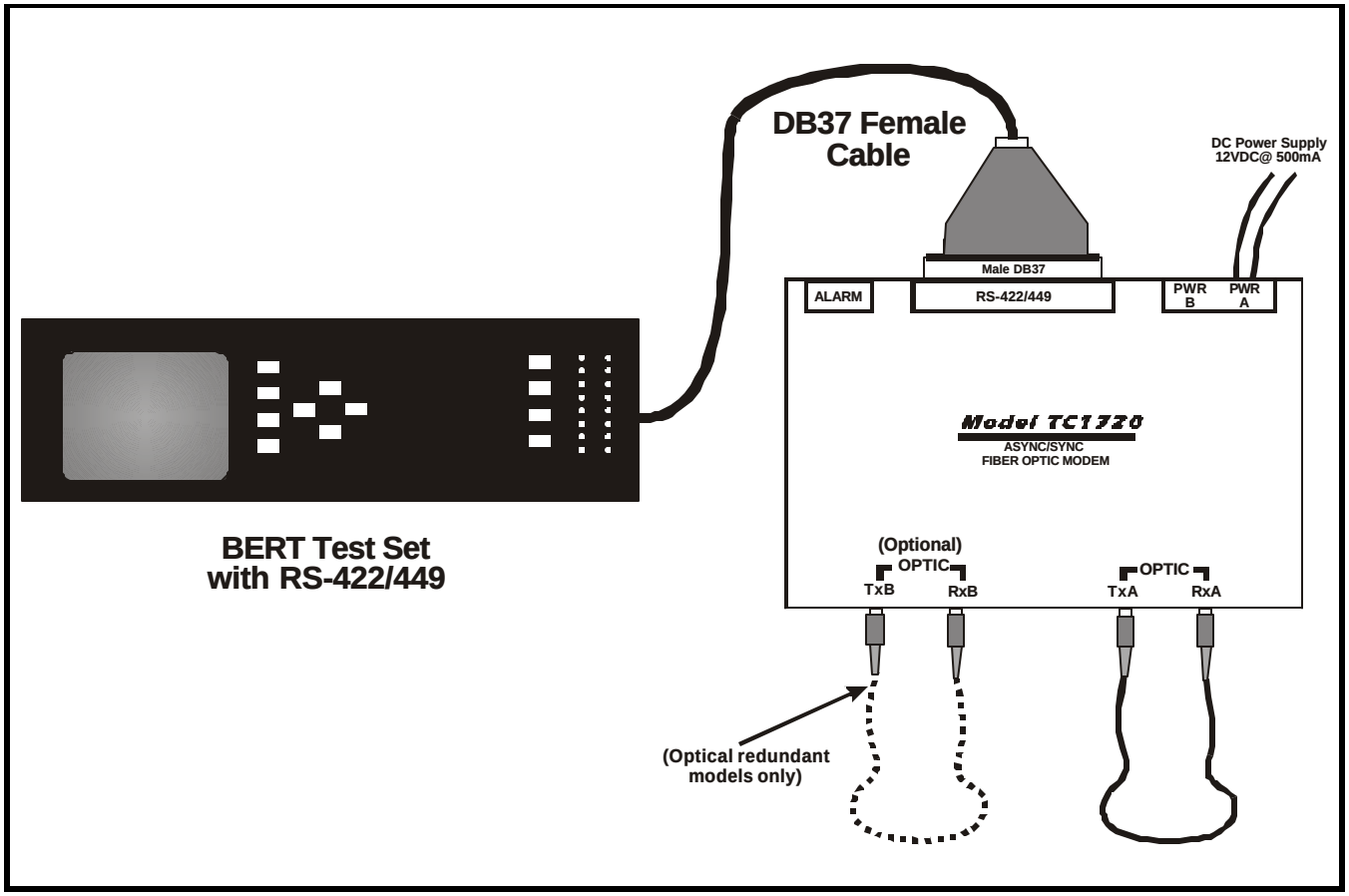


Figure 7. Local Optical Loopback Test Connection Diagram

Remote Optical Loopback Test

1. Connect a second TC1720 unit. As with the first unit, from doing the local optical loopback test, follow the bench test steps on the previous page. When you have completed the local optical loopback test for the second unit, proceed to the next step.
2. Set up the bench test as illustrated in Figure 8 below.
3. Set the BERT test set to the same (or as close to the same) data rate as the application you plan to connect to (typically 19.2Kbps through 128Kbps Synchronous).
4. The data bits should be selected as '8 bits' and the data pattern should be set to '2047' on the BERT tester.
5. Now, on the ***Local Unit Only***, turn the front panel SW2-1 (RMTLB) dip switch to the down "On" position to enable the Remote Loopback Test function. All other dip switches must be up or Off. On the Remote TC1720 all dip switches must be up or Off.
6. At this point, the tester should indicate a Synchronous signal being received (if the optical cable and connectors are good and the cable has been connected properly).
7. Verify the following LEDs on both the Local and Remote TC1720 units:

   On the Local unit, the "TxD," "RxD," "TxClk," "RxClk," "RxA," "PWRA or PWRB," and "Vcc" LEDs are solidly lit. The "ALARM" LED and all other LEDs will be off.

   On the Remote unit, the "TxD," "RxD," "TxClk," "RxClk," "RxA," "PWRA or PWRB," and "Vcc" LEDs are solidly lit. The "ALARM" LED will be in a flashing mode, indicating the unit is diagnostic mode.

   You should not see any bit errors. To verify this, inject an error using the BERT tester to see if it will be recorded by the tester, then verify that no additional errors appear after the user injected error.
8. When done with this test, make sure to return the Local unit's front panel SW2-1 (RMTLB) dip switch to the up "Off" position to disable to Remote Optical Loopback test function to proceed with other tests.

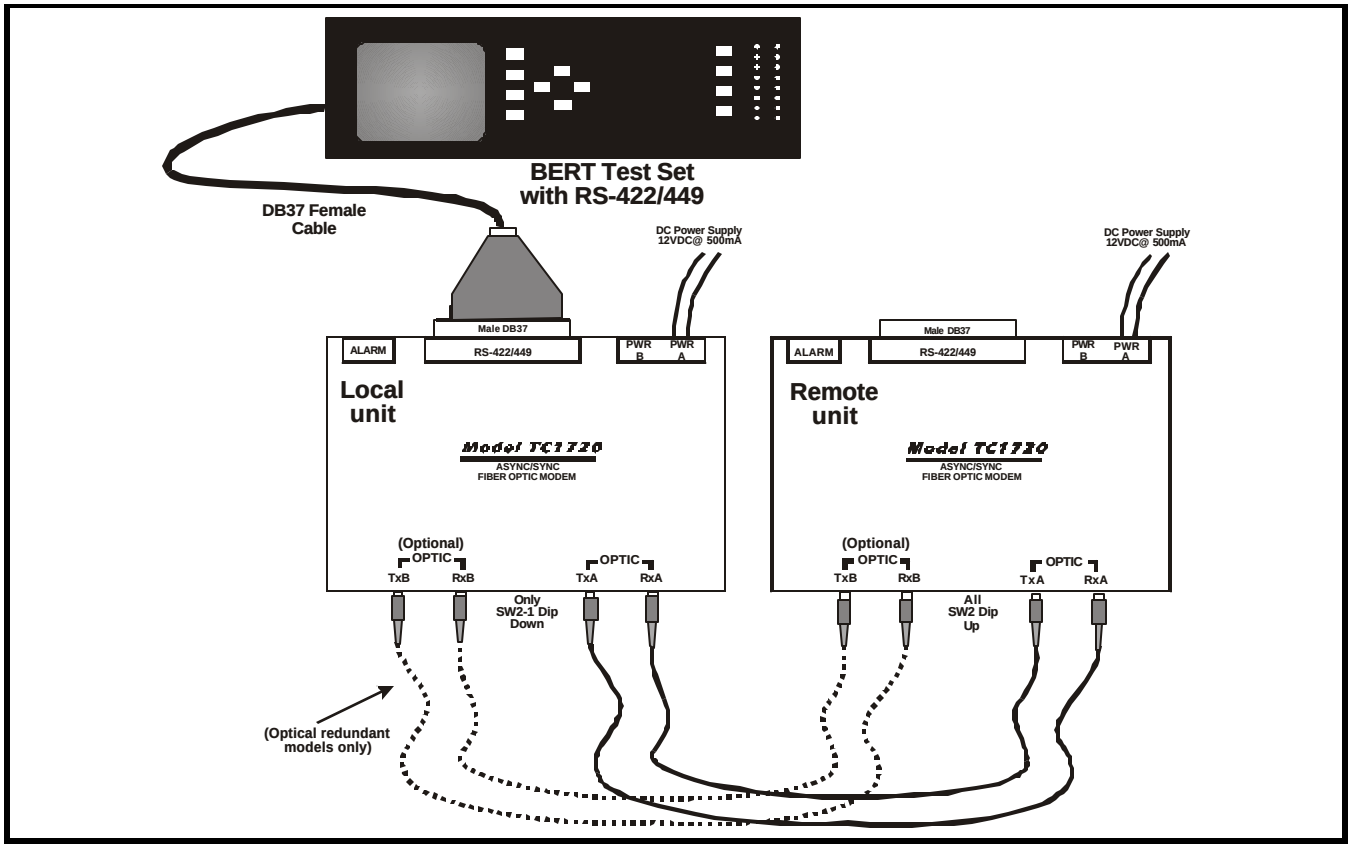


Figure 8. Remote Optical Loopback Test Connection Diagram

Remote Electrical Loopback Test

1. Set up the bench test as illustrated in Figure 9 below. Make sure all front panel SW2 dip switches on both the Local & Remote TC1720's are to the up "Off" position.

2. Connect four copper-wire jumpers to short (loopback) the DB37 Male connector on the rear of the remote unit as follows (these copper-wire connections will loopback the signal at the remote TC1720):

Pin 4 (+SD) to Pin 6 (+RD)
Pin 22 (-SD) to Pin 24 (-RD)
Pin 17 (+TT) to Pin 8 (+RT)
Pin 35 (-TT) to Pin 26 (-RT)

3. Set the BERT test set to the same (or as close to the same) data rate as the application you plan to connect to (typically 19.2Kbps through 128Kbps Synchronous).

4. The data bits should be selected as '8 bits' and the data pattern should be set to '2047' on the BERT tester.

5. At this point, the tester should indicate a Synchronous signal being received (if the optical cable and connectors are good and the electrical cable has been connected properly).

6. Verify that the "TxD," "RxD," "TxClk," "RxClk," "RxA," "PWRA or PWRB," and "Vcc" LEDs are solidly lit on both the Local and Remote TC1720s. Note, the "ALARM" LED will be "Off" since there are optical fiber cables connected. All other LEDs should be off.

   You should not see any bit errors. To verify this, inject an error using the BERT tester to see if it will be recorded by the tester, then verify that no additional errors appear after the user injected error.

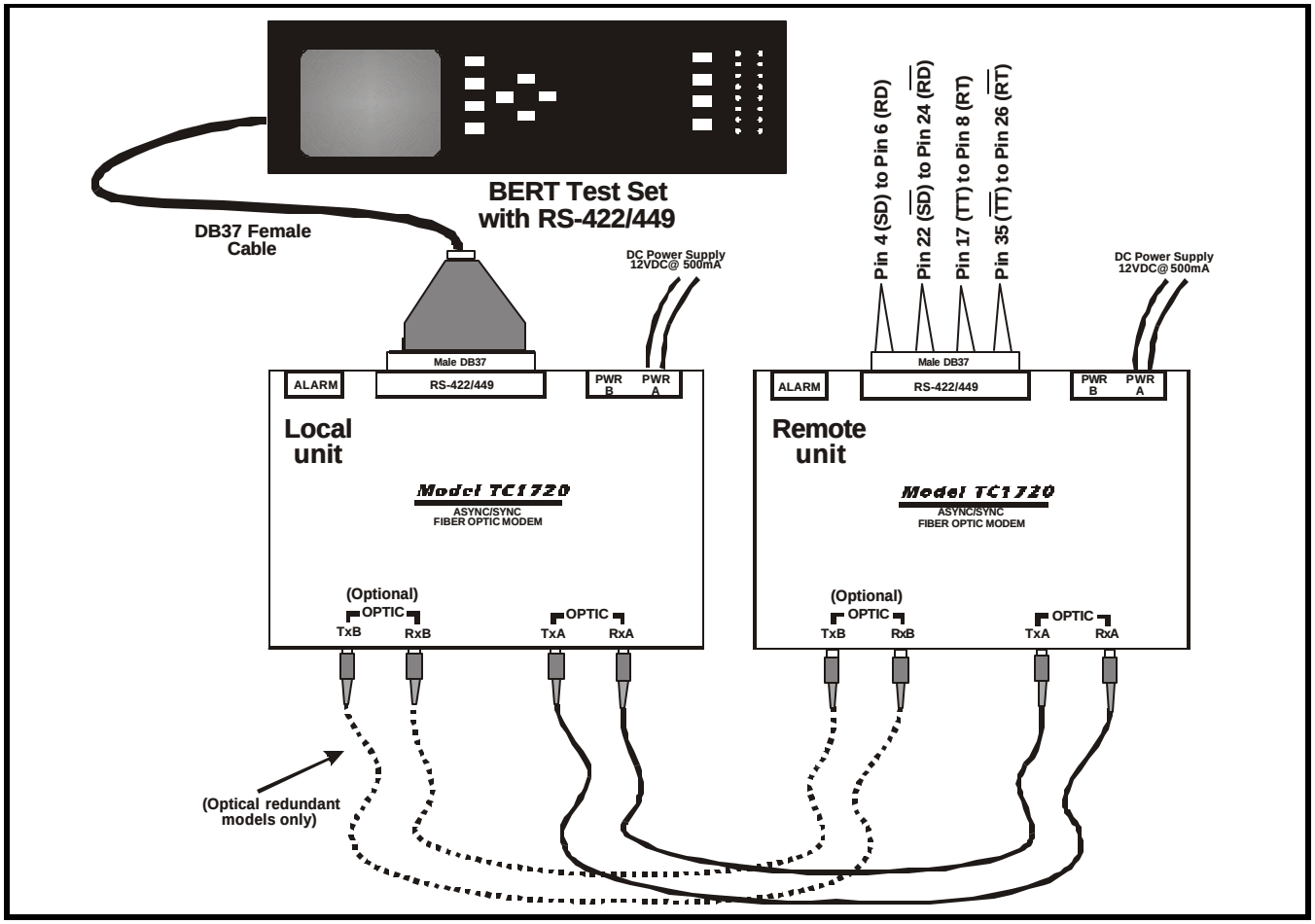


Figure 9. Remote Electrical Loopback Test Connection Diagram

Bench Test With Built-In Signal Generator

The TC1720 has built-in signal generator to simulate a polling device's incoming electrical signal. The built -in signal generator is a pulse signal indicated by blinking LED. The flash rate is intentionally reduced for easy visual confirmation.

The purpose of the Signal Generator Test is to verify the optical connections and the clock signal of the units.

Important Note:

Before proceeding with the Signal Generator test, please read the Warranty Note on page 10.

1. Setup the bench test as shown in Figure 10.

2. At the local TC1720 unit, turn on the "SIG-GEN" by sliding SW1-1 (switch 1 of the "SW1 Internal DIP Switch") to the right (on) position.

2a. For "Sync" units(SW1-4: disabled "Off"): Turn on the "RMTLB" by pressing down the DIP switches #1 of "Front Panel DIP Switches" on the Local TC1720. The "TxD & RxD," "RTS & CTS," "CD & CD," "TxClk & RxClk" LEDs on the local TC1720 should light sequentially from top to bottom. Likewise, the same flashing LED sequence should be observed on the Remote TC1720 indicating receipt of the local unit's simulated response.

3. When done with this test, turn off the "SIG-GEN" by sliding SW1-1 (switch 1 of the "SW1 Internal DIP Switch") to the left (off) position.

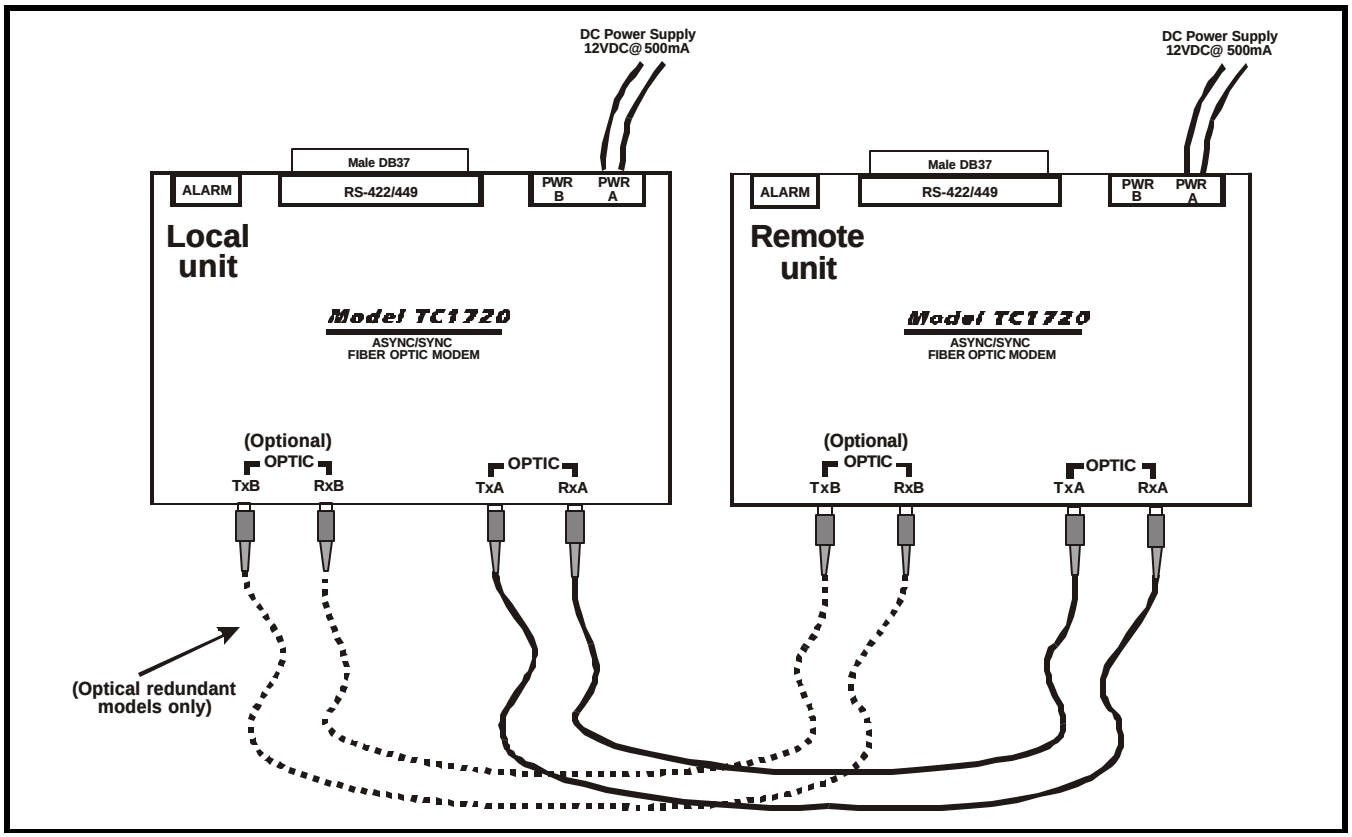
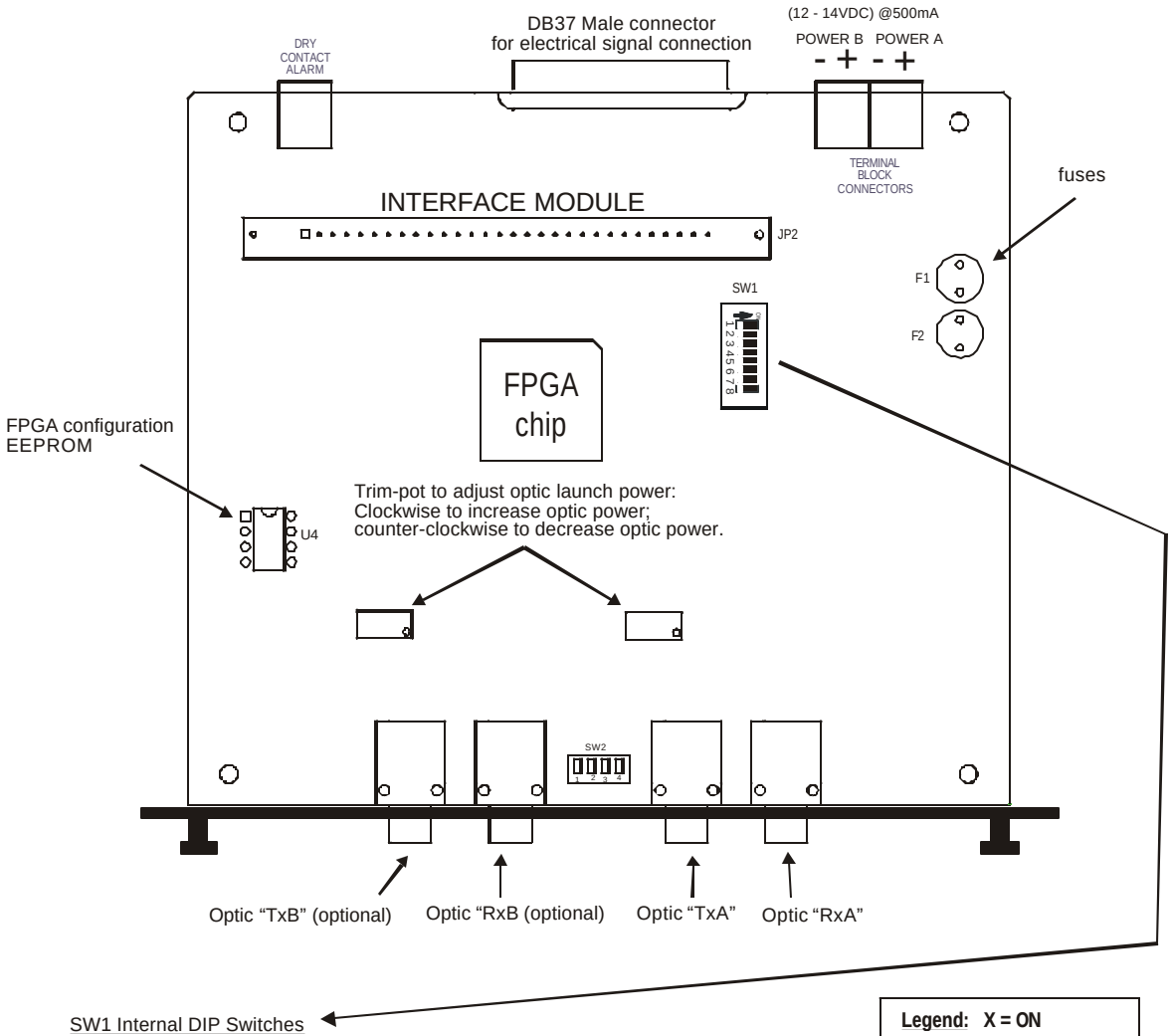


Figure 10. Signal Generator Bench Test Connection Diagram

Chapter 5 - Component Placement



SW1 Internal DIP Switches

Used to configure TC1720:
to enable the signal generator test,
to change DCE (Off) or DTE (On) device,
to enable secondary optic receiver, and
to select the internal clock rate.
SW1-1: enable signal generators
SW1-2: configure TC1720's interface as DCE or DTE
SW1-3: enable RxB
SW1-4: enable Async/Sync mode

Legend: X = ON

This table shows the Internal Clock speed when the TC1720 is DCE, on DB37 pin 5 & 23.

For Oscillator: 8.192Mhz

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SW1-5:		X		X		X		X		X		X		X		X
SW1-6:			X	X			X	X			X	X			X	X
SW1-7:					X	X	X	X					X	X	X	X
SW1-8:									X	X	X	X	X	X	X	X
		8k	9.6k	16k	19.2k	32k	38.4k	56k	64k	128k	256k	512K	1.024M	2.048M	4.096M	5 - 10M

Figure 11. Component Locations on TC1720's Internal PCB (with optional Dual Optics)

Chapter 6 - Specifications

Data Rates

Asynchronous ..... Up to 10 Mbps
Synchronous ..... Up to 5 Mbps

Optical

Transmitter ..... LED/LASER with AGC
Receiver ..... Pin Diode
Wavelength ..... 1310nm Multimode
..... 1310/1550nm Single Mode
Connector ..... ST* or FC
Loss Budget ..... 15dB Multimode 1310nm @62.5/125µm**
..... 20dB Single Mode 1310/1550nm @9/125µm

Electrical

Interface RS-422/RS-449
Connector ..... DB37 Male

System

Bit Error Rate ..... 1 in 10^9 or better

Indicators

System status ..... ALARM, PWR A, PWR B, Vcc, Rx-A, Rx-B, USE-B, DTE
Electrical Signal Status ..... RxD, TxD
Optic Signal Status ..... TxA, RxB (for Dual Optics, TxB and RxB)

Power Source

Standard ..... 12VDC @500mA (typical)
Optional ..... 24VDC, 48VDC, or 115/230VAC with an external power cube

Temperature

Operating ..... -10°C to 50°C
..... Hi-Temp Version (optional) -20°C to 70°C
..... Extreme-Temp Version (optional) -40°C to 85°C
Storage ..... -40°C to 90°C
Humidity ..... 95% non-condensing

Physical (Rackmount Card)

Height ..... (3.53 cm) 1.39"
Width ..... (18.13 cm) 7.14"
Depth ..... (16.59 cm) 6.53"
Weight ..... (192 gm) 5.44 oz

ST is a trademark of AT&T
Contact factory for loss budget requirements greater than 20dB (Laser version).

Appendix A

Return Policy

To return a product, you must first obtain a Return Material Authorization number from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please provide a description of the problem and any results of diagnostic tests that have been conducted.

Warranty

Damages by lightning or power surges are not covered under this warranty.

All products manufactured by TC Communications, Inc. come with a five year (beginning 1-1-02) warranty. TC Communications, Inc. warrants to the Buyer that all goods sold will perform in accordance with the applicable data sheets, drawings or written specifications. It also warrants that, at the time of sale, the goods will be free from defects in material or workmanship. This warranty shall apply for a period of five years from the date of shipment, unless goods have been subject to misuse, neglect, altered or destroyed serial number labels, accidents (damages caused in whole or in part to accident, lightning, power surge, floods, fires, earthquakes, natural disasters, or Acts of God.), improper installation or maintenance, or alteration or repair by anyone other than Seller or its authorized representative.

Buyer should notify TC Communications, Inc. promptly in writing of any claim based upon warranty, and TC Communications, Inc., at its option, may first inspect such goods at the premises of the Buyer, or may give written authorization to Buyer to return the goods to TC Communications, Inc., transportation charges prepaid, for examination by TC Communications, Inc. Buyer shall bear the risk of loss until all goods authorized to be returned are delivered to TC Communications, Inc. TC Communications, Inc. shall not be liable for any inspection, packing or labor costs in connection with the return of goods.

In the event that TC Communications, Inc. breaches its obligation of warranty, the sole and exclusive remedy of the Buyer is limited to replacement, repair or credit of the purchase price, at TC Communications, Inc.'s option.

To return a product, you must first obtain a Return Material Authorization (RMA) number and RMA form from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please fill out RMA form provided with a description of the problem(s) and any results of diagnostic tests that have been conducted. The shipping expense to TC Communications should be prepaid. The product should be properly packaged and insured. After the product is repaired, TC Communications will ship the product back to the shipper at TC's cost to U.S. domestic destinations. (Foreign customers are responsible for all shipping costs, duties and taxes [both ways]. We will reject any packages with airway bill indicating TC communications is responsible for Duties and Taxes. To avoid Customs Duties and Taxes, please include proper documents indicating the product(s) are returned for repair/retest).