User Manual for the
HE200CFM100

CAN Fiber Optic Modem

Second Edition
17 September 1999

MAN0007-02

PREFACE

This manual explains how to use the Horner APG's CAN Fiber Optic Modem.

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To obtain warranty service, return the product to your distributor with a description of the problem, proof of purchase, post paid, insured and in a suitable package.

ABOUT PROGRAMMING EXAMPLES

Any example programs and program segments in this manual or provided on accompanying diskettes are included solely for illustrative purposes. Due to the many variables and requirements associated with any particular installation, Horner APG cannot assume responsibility or liability for actual use based on the examples and diagrams. It is the sole responsibility of the system designer utilizing CAN Fiber Optic Modem to appropriately design the end system, to appropriately integrate the CAN Fiber Optic Modem and to make safety provisions for the end equipment as is usual and customary in industrial applications as defined in any codes or standards which apply.

Note: The programming examples shown in this manual are for illustrative purposes only. Proper machine operation is the sole responsibility of the system integrator.

Revisions to this Manual

This version (MAN0007-02) of the CAN Fiber Optic Modem User Manual contains the following substantive revisions, additions and deletions.

a. Renamed Chapter 1 as “Introduction.”

b. Revised Chapter 1 by adding ring topology in Section 1.1 and 1.2.2. The previous version of the CAN Fiber Optic modem only covered star topology networks.

c. Added Table 1.1 to cover specifications.

d. Renamed Chapter Two as “Installation.”

e. Added Section 2.1, CAN Port and Wiring. Includes Table 2.2, which covers CAN network baud rate vs. total cable length.

f. Added Section 2.2, CAN Wiring Rules.

g. Moved Section 2.1.1, “Dip Switches,” to Section 2.3. Revised Section 2.3 to indicate that the network topology, ring ID, and CAN bus baud rate are set at power-up using internal eight-position dip-switches.

h. Added Table 2.4 with a note to indicate that in a ring network, each modem must have a distinct ID number. This is set at power up using DIP-switch positions 1 through 6. For a star network topology, all six positions are closed.

i. Redrew and renamed Figure 3 as Figure 3.1.

j. Added Figure 3.2 to depict a star topology (full connection) and added Figure 3.3 depict a ring topology configuration.

k. Deleted Chapter 4, LED Indicators and moved into Section 2.4.

l. Revised Table 4.1, 11-Bit ID Ring Topology.

m. Changed company name from Horner Electric, Inc. to Horner APG, LLC.

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CHAPTER 1: INTRODUCTION

1.1 General

The CAN Fiber Optic modem can be configured for star or ring topology networks.

1.2 Product Description

The CAN modem uses the Intel 87C196CA integrated CAN controller microprocessor. Due to the nature of the Intel architecture, remote request messages may not be transmitted over the fiber optic link. Normal CAN data messages are transmitted transparently. The current firmware supports 11-bit CAN IDs.

1.2.1 Star Topology

In a star topology network, two modems are connected at each end of a fiber optic full duplex pair to connect the two CAN networks. Each of these networks may contain other modem links to additional CAN networks. In the case of a single remote CAN device for each fiber link, two modems are required for each remote device. This topology is very robust and the failure of a remote node does <u>not</u> affect the rest of the network.

1.2.2 Ring Topology

In a ring topology network, each local CAN network is again connected to one modem but all the modems in a network are connected in a fiber optic ring to each other. This reduces the number of modems required for a given installation and also uses less fiber optic cable. Up to 63 modems may be connected in a single ring. There are three disadvantages to ring topology. First, since all messages pass through all modems, a single failure will interrupt network traffic until repaired. Second, each modem handles all the network traffic so the total network throughput is reduced. Third, since each modem receives, queues, and retransmits each message, the message latency is longer than for the star network topology.

1.3 Specifications

Table 1.1 – HE200CFM100 Specifications

Maximum Nodes in a Ring Network	63	Cable	62.5 Micron Multi-Mode Fiber
Maximum Distance	5,000 Feet	Connectors on ends of cable	ST connectors
Required Power (Steady State)	TBA	CE	Pending
Required Power (Inrush)	TBA	UL	Pending
Relative Humidity	5 to 95% Non-condensing	Terminal Type	TBA
Operating Temperature	0° to 60° Celsius	Weight	TBA

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CHAPTER 2: INSTALLATION

2.1 CAN Port and Wiring

The CAN interface is DeviceNet compliant. It uses the DeviceNet power supply, 11-25VDC.

Table 2.1 – CAN Port Pins		
Pin	**Signal**	**Description**
1	V-	Power -
2	CN_L	Signal -
3	SHLD	Shield
4	CN_H	Signal +
5	V+	Power +

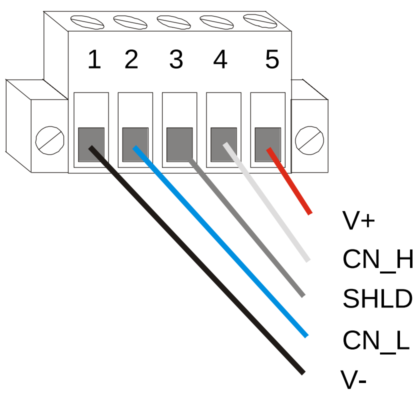

Figure 2.1 – CAN Port Connector

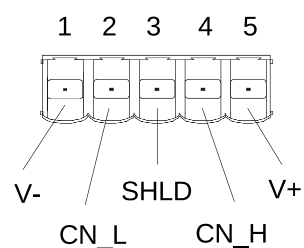

Figure 2.2 – As viewed looking at the CFM100

Table 2.2 – CAN Network Baud Rate vs.Total Cable Length	
Network Data Rate	**Maximum Total Cable Length**
1Mbit /sec	40 meters (131 feet)
500Kbit / sec	100 meters (328 feet)
250Kbit / sec	200 meters (656 feet)
125Kbit / sec	500 meters (1640 feet)

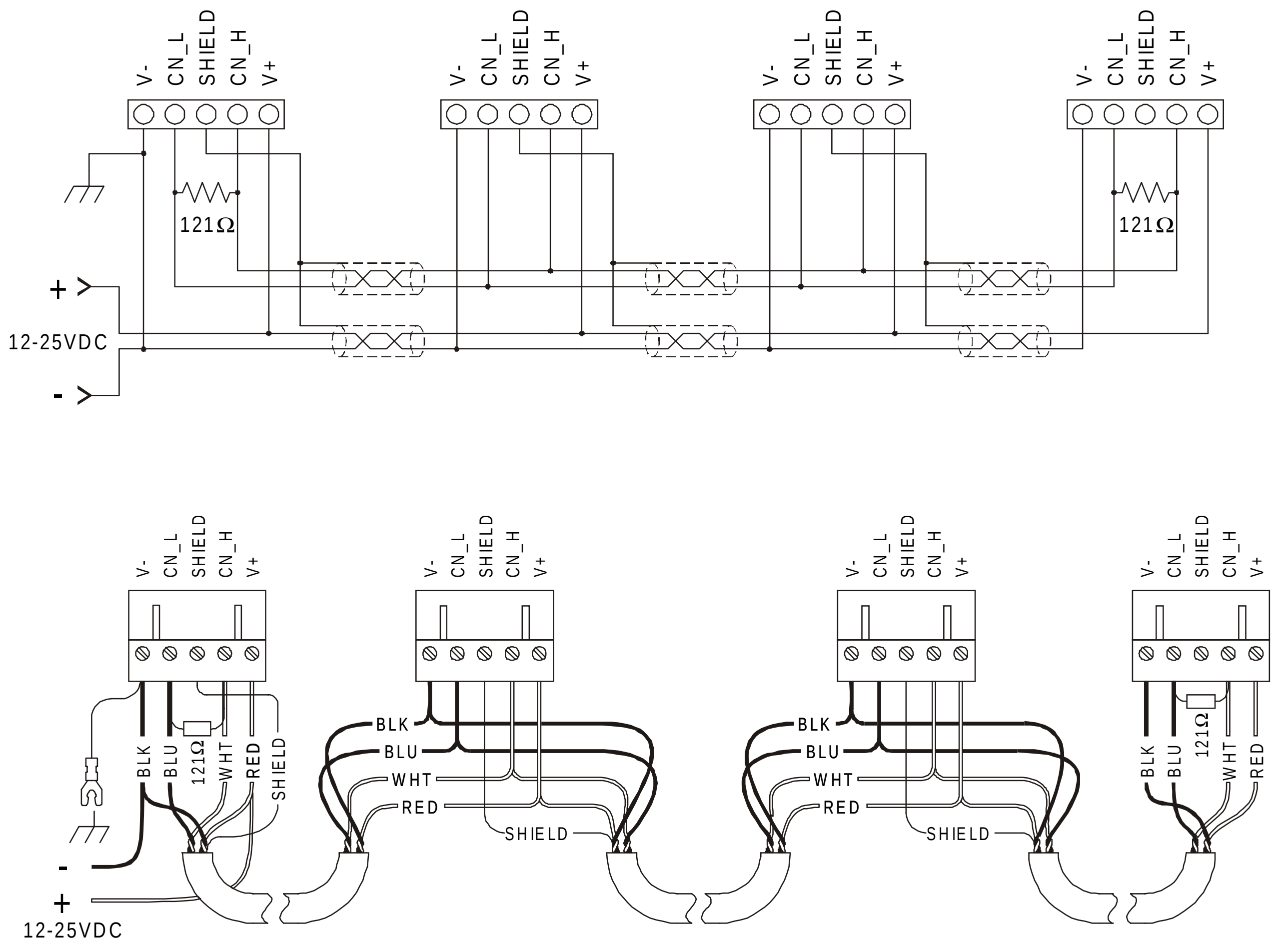

Figure 2.3 – CAN Wiring

2.2 CAN Wiring Rules (See Figure 2.3)

1. Wire the CAN network in a daisy-chained fashion such that there are exactly two physical end-points on the network.
2. The two nodes at the physical end-points need to have 121 ohm 1% terminating resistors connected across the CN_L and CN_H terminals.
3. Use data conductors (CN_L and CN_H) that are 24 AWG shielded twisted pair for "thin cable" and 22 AWG shielded twisted pair for "thick cable." They must also have 120-ohm characteristic impedance. In typical industrial environments, use a Belden wire #3084A ("thin"). Use #3082A ("thick") for environments where noise is a concern.
4. Use power conductors (V- and V+) that are 18 AWG twisted-pair for "thin cable" and 15 AWG twisted-pair for "thick cable."
5. Connect the V- power conductor to a good earth ground **at one place only** on the network, preferably physical endpoints.
6. For a section of cable between two nodes, the cable shield is connected to the cable shield input at *one end of the cable only.*
7. A CAN network (without repeaters) is limited to 64 nodes (with 63 cable segments) with a maximum cable length of 1500 ft.
8. Up to four CAN network segments, which adhere to the above rules, may be connected together using three CAN repeaters. In this manner, a CAN network may be extended to 253 nodes with a total cable distance of 6000 ft.

2.3 Dip Switch Settings

The network topology, ring ID, and CAN bus baud rate are set at power-up using the internal eight-position dip switches. **(See Table 2.2.) The CAN bus baud rate is set at power up using DIP switch positions 7 and 8**. The switches are located on the top side of the Modem. SW8 is on the end nearest the fiber optic connectors. The dip switches can be found inside the housing of the modem on the circuit board. **There are eight screws that need to be removed prior to using the dip switches. Four of the screws will need to be removed from the top side of the housing and an additional 4 on the bottom side.**

Note: The default switch settings are closed.

Table 2.3 – Dip Switch Settings (7 and 8)

Switch 7	Switch 8	CAN Baud Rate
Closed	Closed	125K
Open	Closed	250K
Closed	Open	500K
Open	Open	1M

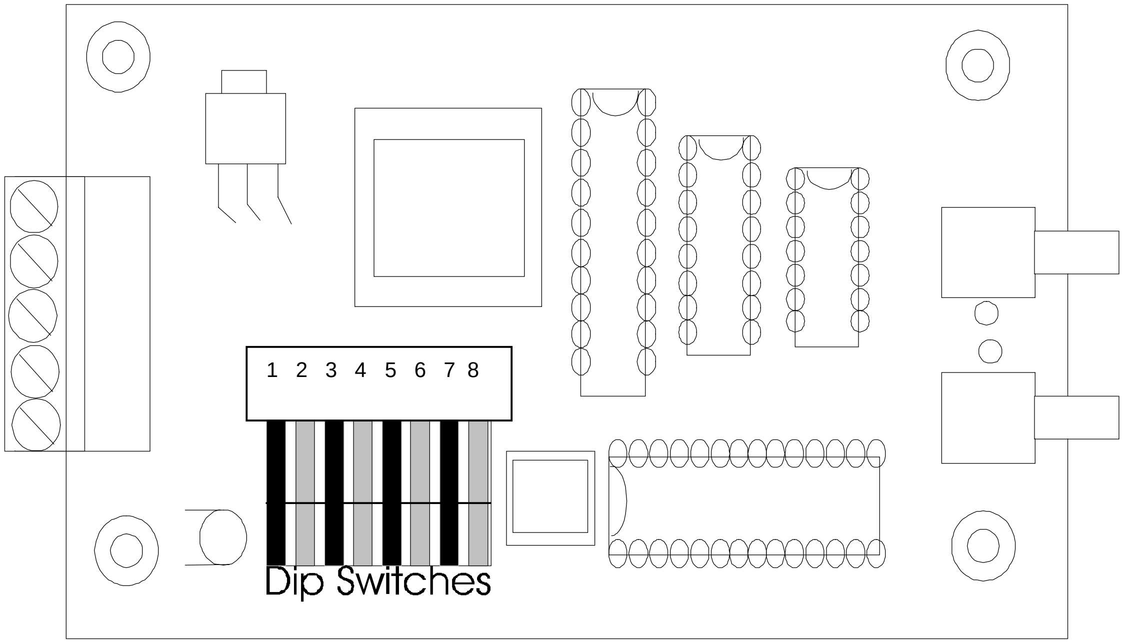

Figure 2.4 – Dip Switches

Table 2.4 – Dip Switch Settings (1 through 6)

Note: In a ring network, each modem must have a distinct ID number. This is set at power up using DIP switch positions 1 through 6. For a star network topology, all six positions are closed.

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Ring Id
Closed	Closed	Closed	Closed	Closed	Closed	Star
Open	Closed	Closed	Closed	Closed	Closed	1
Closed	Open	Closed	Closed	Closed	Closed	2
Open	Open	Closed	Closed	Closed	Closed	3
Closed	Closed	Open	Closed	Closed	Closed	4
Open	Closed	Open	Closed	Closed	Closed	5
Closed	Open	Open	Closed	Closed	Closed	6
Open	Open	Open	Closed	Closed	Closed	7
Closed	Closed	Closed	Open	Closed	Closed	8
Open	Closed	Closed	Open	Closed	Closed	9
Closed	Open	Closed	Open	Closed	Closed	10
Open	Open	Closed	Open	Closed	Closed	11
Closed	Closed	Open	Open	Closed	Closed	12
Open	Closed	Open	Open	Closed	Closed	13
Closed	Open	Open	Open	Closed	Closed	14
Open	Open	Open	Open	Closed	Closed	15

Table 2.4 continued

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Ring Id
Closed	Closed	Closed	Closed	Open	Closed	16
Open	Closed	Closed	Closed	Open	Closed	17
Closed	Open	Closed	Closed	Open	Closed	18
Open	Open	Closed	Closed	Open	Closed	19
Closed	Closed	Open	Closed	Open	Closed	20
Open	Closed	Open	Closed	Open	Closed	21
Closed	Open	Open	Closed	Open	Closed	22
Open	Open	Open	Closed	Open	Closed	23
Closed	Closed	Closed	Open	Open	Closed	24
Open	Closed	Closed	Open	Open	Closed	25
Closed	Open	Closed	Open	Open	Closed	26
Open	Open	Closed	Open	Open	Closed	27
Closed	Closed	Open	Open	Open	Closed	28
Open	Closed	Open	Open	Open	Closed	29
Closed	Open	Open	Open	Open	Closed	30
Open	Open	Open	Open	Open	Closed	31
Closed	Closed	Closed	Closed	Closed	Open	32
Open	Closed	Closed	Closed	Closed	Open	33
Closed	Open	Closed	Closed	Closed	Open	34
Open	Open	Closed	Closed	Closed	Open	35
Closed	Closed	Open	Closed	Closed	Open	36
Open	Closed	Open	Closed	Closed	Open	37
Closed	Open	Open	Closed	Closed	Open	38
Open	Open	Open	Closed	Closed	Open	39
Closed	Closed	Closed	Open	Closed	Open	40
Open	Closed	Closed	Open	Closed	Open	41
Closed	Open	Closed	Open	Closed	Open	42
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Open	Closed	Open	Open	Closed	Open	45
Closed	Open	Open	Open	Closed	Open	46
Open	Open	Open	Open	Closed	Open	47
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Open	Closed	Closed	Open	Open	Open	57
Closed	Open	Closed	Open	Open	Open	58
Open	Open	Closed	Open	Open	Open	59
Closed	Closed	Open	Open	Open	Open	60
Open	Closed	Open	Open	Open	Open	61
Closed	Open	Open	Open	Open	Open	62
Open	Open	Open	Open	Open	Open	63

2.4 LED Indicators

The HE200CFM100 provides two (Red) diagnostic LEDs. The Transmit (TX) LED and the Receive (RX) LEDs are both located on the opposite end from the CAN connector.

The LEDs provide indications of fiber optic transmit and receive communication activity respectively.

CHAPTER 3: FIBER OPTIC LINK

3.1 General

The fiber optic link uses ST connectors on 62.5/125 µm multimode cable and transmit up to 1200 meters on unspliced cable.

There must be (2) fiber optic modems between each isolated module (e.g. PLC or sensor) on the CAN network. Transmit and receive LEDs are provided to monitor link activity.

The TXD output of the first modem is connected to the RXD input of the second and the TXD output of the second is connected to the RXD input of the first using the fiber optic link cable.

The total data throughput for the CAN Fiber Optic Modem is 500 one data byte CAN messages per second or 250 eight data byte CAN messages per second. This performance includes formatting, ID, and check bytes.

3.2 Star Topology

The following are examples of of Star topologies. For wiring and connector diagrams relative to modules other than the HE200CFM100, refer to the necessary manuals for additional information.

**Note the relationship between TXD and RXD using the fiber optic link cable.

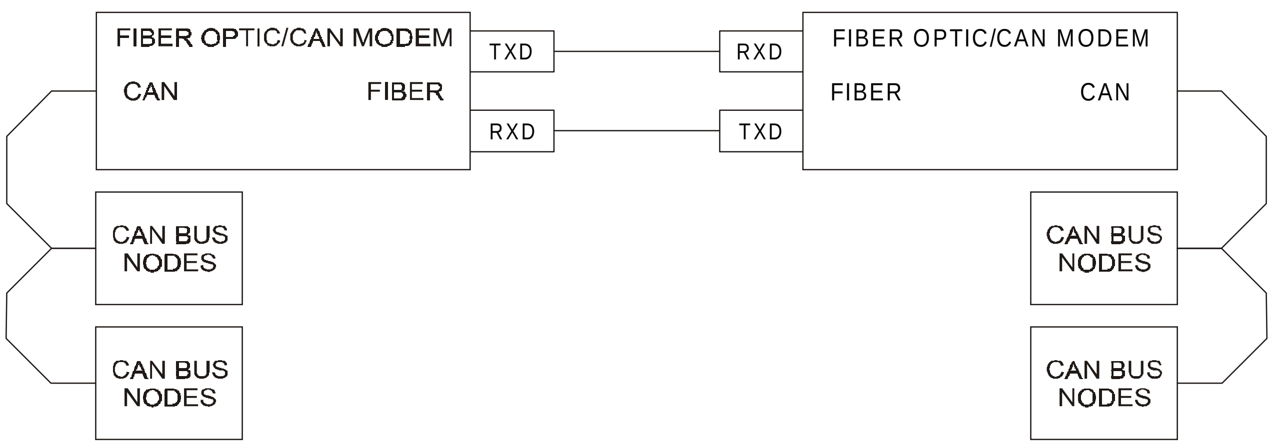

Figure 3.1 – Star Network
(Single Point-to-Point Connection)

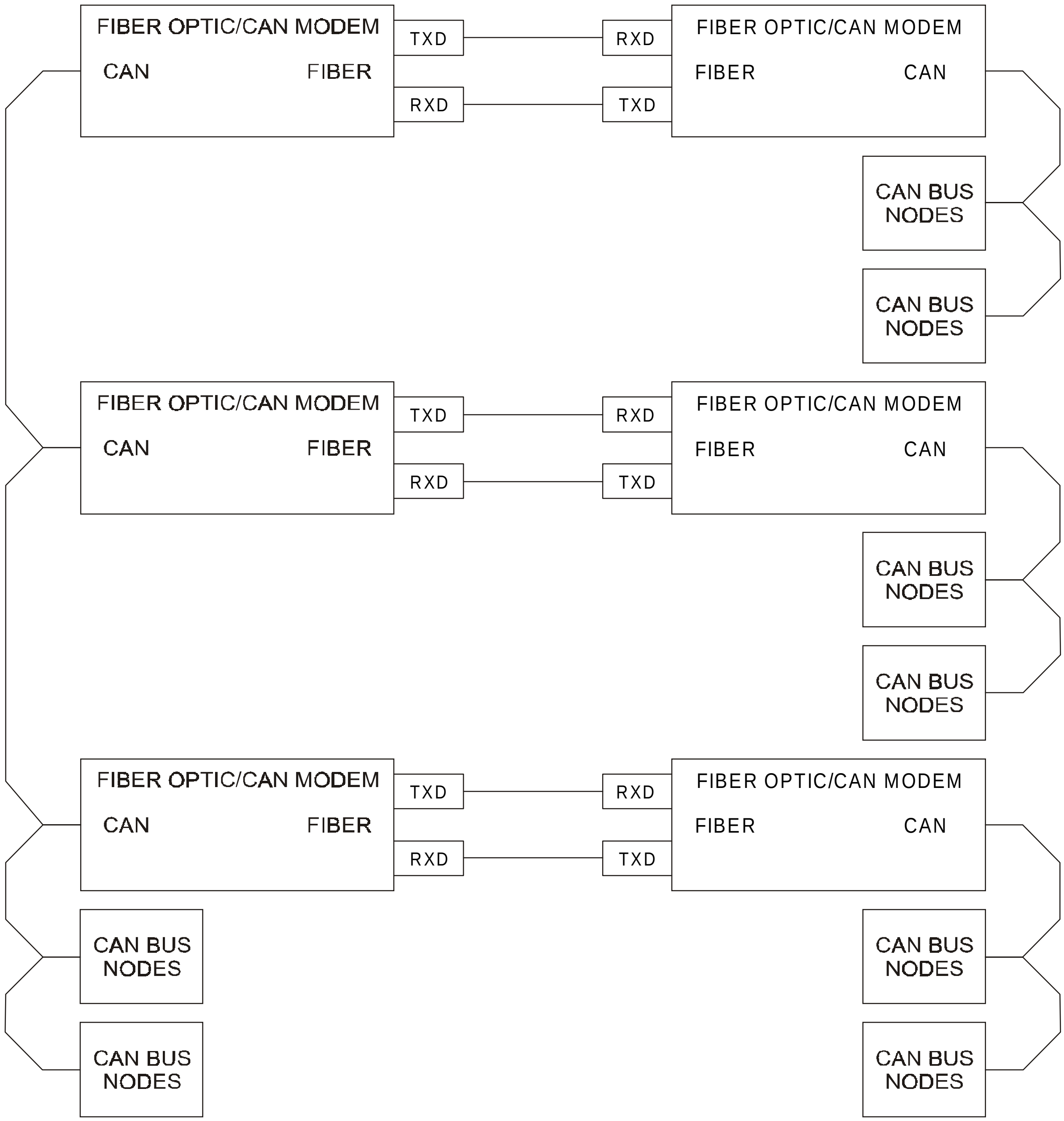

Figure 3.2 - Star Network
(Full Star Connection)

3.3 Ring Topology

For a ring topology network, each isolated sensor or CAN bus connects to a single modem. The TXD output of the first modem is connected to the RXD input of the next. This continues around the ring until the TXD output of the last modem connects back to the RXD input of the first modem. All the modems the ring must have different ID numbers but they may be physically connected in any order. The ring network throughput per second is approximately 500 one data byte CAN messages or 250 eight data byte CAN messages divided by the number of modems in the ring.

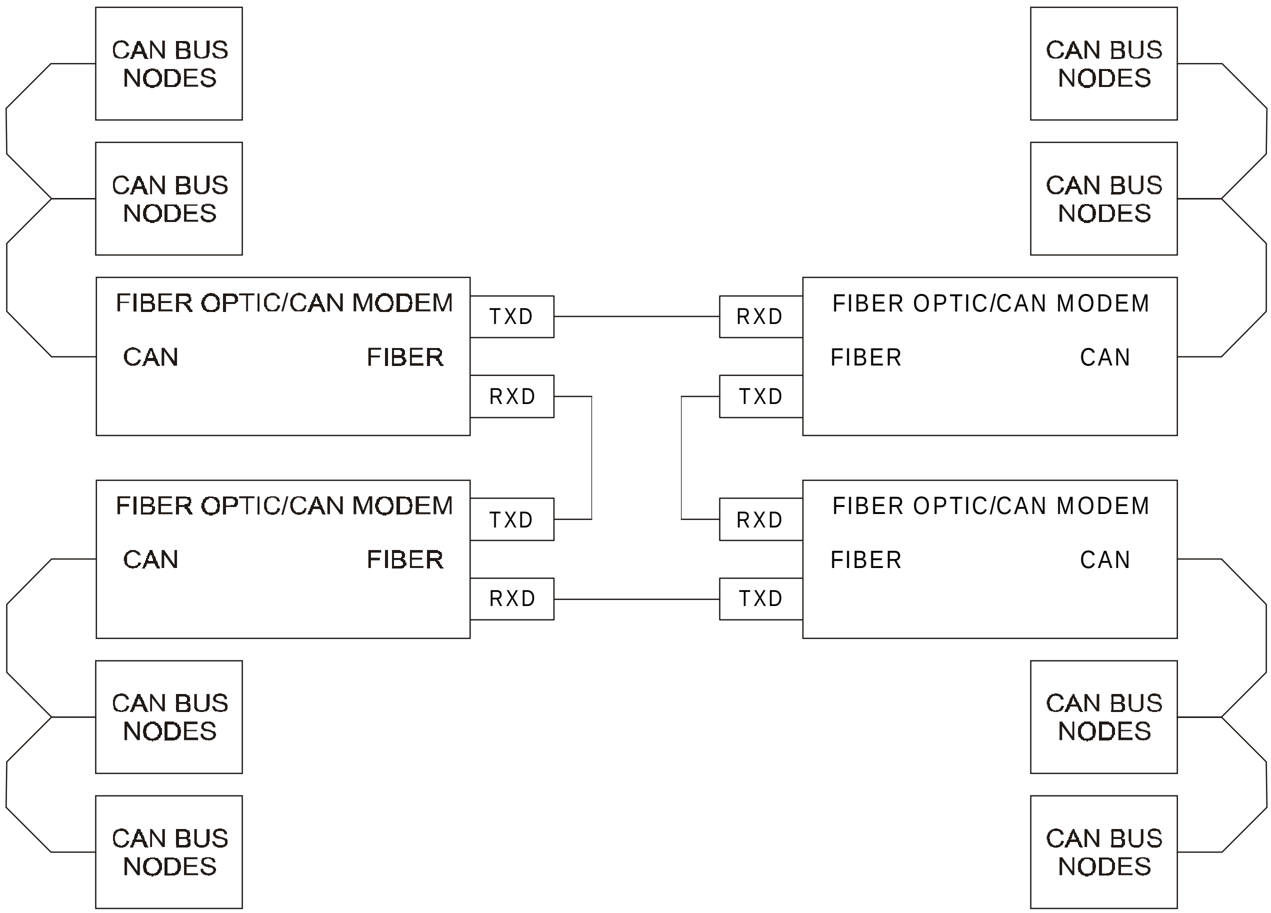

Figure 3.3 – Ring Network

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