

FSK MODEM

USERS MANUAL
REVISION 2.1

June, 1989

COPYRIGHT © 1988

MILLE APPLIED RESEARCH CO., INC.
HOUSTON, TEXAS
713/641-6272

FSK MODEM PROPRIETARY NOTICE

i

PROPRIETARY NOTICE

Proprietary rights of **MILLE APPLIED RESEARCH CO., INC. (MARC)** are involved in this subject matter and all manufacturing, reproduction, use and sales rights pertaining to such subject matter are expressly reserved. It is submitted in confidence for a specified purpose and the recipient, by accepting this material, agrees that this material will not be used, copied or reproduced in whole or in part, nor its contents revealed in any manner or to any person except to meet the purpose for which it was delivered.

i

FSK MODEM TABLE OF CONTENTS

TABLE OF CONTENTS

1 GENERAL INFORMATION	1
1.1 INTRODUCTION	1
1.2 GENERAL DESCRIPTION	1
2 SPECIFICATIONS	2
3 INTERFACE CONNECTIONS.....	3
3.1 RS-232 CONNECTOR	3
3.1.1 Pin 1 Data Carrier Detect	3
3.1.2 Pin 2 Transmit Data.....	4
3.1.3 Pin 3 Receive Data.....	4
3.1.4 Pin 4 Data Terminal Ready.....	4
3.1.5 Pin 5 Ground Reference.....	4
3.1.6 Pin 7 Request To Send.....	4
3.1.7 Pin 8 Clear To Send.....	5
3.1.8 Pin 9 Ring Indicator	5
3.2 ANALOG SIGNAL CONNECTIONS.....	5
4 MODEM OPERATING MODE SELECTION	6
4.1 OPERATING MODE SELECTION SWITCH.....	6
4.1.1 Frequency Parameters	7
4.1.2 Timing Parameters	7
4.2 TRANSMIT LEVEL SELECTION.....	7

LIST OF FIGURES

Figure 1 Interface Signals.....	3
Figure 2 Option Switch Settings	6
Figure 3 Modem Frequency Parameters.....	7
Figure 4 Modem Timing Parameters.....	8

GENERAL DESCRIPTION

1.1 INTRODUCTION

This Manual details the information necessary for set-up and operation of the MARC™ Modem board for the Allen-Bradley Programmable Logic Controller (PLC). The modem board is MARC Part Number 137-001.

The 137-001 Modem is an asynchronous Frequency Shift Keying (FSK) voiceband modem intended for use in leased line applications. The Modem can be used in either 2-Wire or 4-Wire configurations. It is switch selectable for operating mode and baud rates of 300, 600 or 1200 bits per second (bps). The Modem is compatible with the applicable Bell and CCITT recommended standards for 103/13/108, 202, V.21 and V.23 type modems.

The transmit signal level from the Modem is switch selectable by the user from +2 to -12 dbm for added versatility.

The interface signal levels to the Modem conform to the RS232-C standard. A standard RJ11 telephone line connector is located on the front panel of the Modem for easy connection to the communication line.

The Modem card obtains +5VDC power from the PLC backplane connector. No other connections to the backplane are made.

SPECIFICATIONS

Physical:

- Requires on module slot in an Allen-Bradley 1771 I/O chassis
- 1.1" W X 10" H X 5.75" D (Standard Allen-Bradley Module Size)
- 1 pound, 10 ounces

I/O Connections:

- 15-Pin "D" Connector (DE15S) for RS-232 Interface
- RJ-11 for Communication Line

Compatibility:

- Bell 103/113/108
- Bell 202
- CCITT V.21
- CCITT V.23

User Selectable Options:

- Optional Soft Carrier Turn Off on V.23 Modes
- Full or Half Duplex Operation
- Switch Selectable Operating Mode
- Switch Selectable Transmit Level

Backplane Power Supply Load:

- 750 ma from 5 VDC

Operating Environment:

- 0 to 60 Degrees C
- Relative Humidity 10 to 90% (non-Condensing)

INTERFACE CONNECTIONS

3.1 RS-232C CONNECTOR

Connections to the Comm-Troller or other devices with RS-232C compatible communication ports is made via connector P1 which is a 15-pin "D" connector located near the top of the Modem module. Figure 1 below details the interface connector pin assignments.

PIN	FUNCTION
1	Data Carrier Detect (DCD) output
2	Transmit Data (TXD) input
3	Receive Data (RXD) output
4	Data Terminal Ready (DTR) input
5	Ground Reference
6	Not Connected
7	Request To Send (RTS) input
8	Clear To Send (CTS) output
9	Ring Indicator (RI) input
10 thru 15	Not Connected

Figure 1 Interface Signals

3.1.1 Pin 1 Data Carrier Detect

A high level (>3V) on the data carrier detect output indicates that a valid carrier signal is present at the receiver and has been present for at least a time t_{CDON} , where t_{CDON} depends upon the selected modem configuration. A low on this output (<-3V) signifies that no valid carrier is being received and has not been received for a time, t_{CDOFF} . Data Carrier Detect remains low when Data Terminal Ready is low. Values for t_{RCON} and t_{RCOFF} are configuration dependent and are listed in Figure 4.

3.1.2 Pin 2 Transmit Data

Data to be transmitted onto the phone lines is presented on pin 2. The input signal levels are standard RS-232 voltage levels. A low input on this line (negative voltage) will result in a "MARK" tone on the line. A high input on this line (positive voltage) will result in a "SPACE" tone on the line.

3.1.3 Pin 3 Receive Data

Data received from the phone line and decoded by the modem is present on pin 3. The signals on this line are equivalent to those on pin 2. That is, a "MARK" tone on the line will be indicated by a negative output and a "SPACE" tone by a positive output.

3.1.4 Pin 4 Data Terminal Ready

A high level on this input indicates that the data terminal desires to send and/or receive data via the modem. This signal is gated with all other inputs and outputs so that a high level enables all these signals as well as the internal control logic. A low level disables all TTL I/O pins and the internal modem logic.

3.1.5 Pin 5 Ground Reference

Pin 5 is a ground reference for the RS-232 voltage levels.

3.1.6 Pin 7 Request To Send

A high level on this input instructs the modem to enter the Transmit Mode. This input must remain high for the duration of data transmission. A low level on this input disables the transmitter. The state of this input has no effect if Data Terminal Ready* input is low.

3.1.7 Pin 8 Clear To Send

The Clear To Send (CTS) output goes high at the end of a delay initiated when Request To Send (RTS) goes high. Actual data to be transmitted should not be presented to the transmitted data input until a high is indicated on the Clear To Send output. Normally the user should force the transmitted data input low whenever Clear To Send is off (low). This signal never goes high as long as Data Terminal Ready is low (disabled). Clear To Send goes low at the end of a delay initiated when Request To Send goes low. Values for t_{RCON} and t_{RCOFF} are configuration dependent and are listed in Figure 4.

3.1.8 Pin 9 Ring Input

Pin 9 is used for a "Ring Indicator" input in systems which support this function. Pin 9 should be connected to ground (pin 5) if not used.

3.2 Analog Signal Connection

The telephone line connection is made at connector P2. Connector P2 is a standard RJ-11 modular jack commonly found on most telephone lines. This connector provides the 4-wire connection required. Two line coupling transformers are provided on the modem board for direct connection to the transmit and receive wire pairs in leased line applications. The line coupling transformers each provide an isolated 600 Ohm line connection. Transformers T1 and T2 are designed to meet FCC Part 68 requirements for telephone line connections. The transmit pair (output from the Modem) is on pins 3 and 4 of the RJ-11 connector. This is normally the red/green pair of a standard modular connector. The receive pair (input to the Modem) is on pins 2 and 5 of the modular connector. The receive pair is normally the yellow/black pair. Pins 1 and 6 on the connector are not used.

MODEM OPERATING MODE SELECTION

MODEM OPERATING MODE SELECTION

4.1 OPERATING MODE SELECTION

The desired mode of operation is selected by setting the switches on switch SW1 as defined in the following Figure.

1	2	3	4	5	6	7	8	OPERATING MODE
1	1	1	1	1	XXX			Bell 103 Originate 300bps full duplex
1	1	1	1	0	XXX			Bell 103 Answer 300bps full duplex
1	1	1	0	1	XXX			Bell 202 1200bps half duplex
1	1	1	0	0	XXX			Bell 202 1200bps half duplex w/equalizer
1	1	0	1	1	XXX			CCITT V.21 Originate 300bps full duplex
1	1	0	1	0	XXX			CCITT V.21 Answer 300bps full duplex
1	1	0	0	1	XXX			CCITT V.23 Mode 2 1200bps half duplex
1	1	0	0	0	XXX			CCITT V.23 Mode 2 1200bps half duplex w/equ
1	0	1	1	1	XXX			CCITT V.23 Mode 1 600bps half duplex
1	0	0	1	1	XXX			CCITT V.23 Mode 1 600bps w/soft turn off
1	0	0	0	1	XXX			CCITT V.23 Mode 2 1200bps w/soft turn off
1	0	0	0	0	XXX			CCITT V.23 Mode 2 1200bps w/equalizer and s
0	1	1	0	1	XXX			Bell 202 1200bps full duplex
0	1	1	0	0	XXX			Bell 202 1200bps full duplex w/equalizer
0	1	0	0	1	XXX			CCITT V.23 Mode 2 1200bps full duplex
0	1	0	0	0	XXX			CCITT V.23 Mode 2 1200 bps full duplex w/equ
0	0	1	1	1	XXX			CCITT V.23 Mode 1 600bps full duplex

X = Not Used, 0 = Switch OFF, 1 = Switch ON

Figure 2 Option Switch Settings

FSK MODEM

MODEM OPERATING MODE SELECTION

4.1.1 Frequency Parameters

Selection of the operating mode automatically determines the frequency parameters which will be used in communication. Figure 3 details the frequency parameters for each mode.

MODE	TRANSMIT FREQUENCY		RECEIVE FREQUENCY		SOFT TURN OFF TONE
	SPACE	MARK	SPACE	MARK	
Bell 103 Orig	1070	1270	2025	2225	
Bell 103 Ans	2025	2225	1070	1270	
CCITT V.21 Orig	1180	980	1850	1650	
CCITT V.21 Ans	1850	1650	1180	980	
CCITT V.23 Mode 1	1700	1300	1700	1300	900
CCITT V.23 Mode 2	2100	1300	2100	1300	900
Bell 202	2200	1200	2200	1200	900

Figure 3 Modem Frequency Parameters

4.1.2 Timing Parameters

Selection of the operating mode automatically determines the modem timing parameters which will be in use. Figure 4 details the timing parameters for each operating mode.

4.2 TRANSMIT LEVEL SELECTION

The transmit level is determined by setting the desired switch position on SW2 to the ON position. The Transmit levels are clearly marked near switch SW2. Only one switch position should be in the on position. Transmit levels can be set in 2 db increments from -12 to +2 db.

MODEM OPERATING MODE SELECTION

	t_{RCON} ms	t_{RCOFF} ms	t_{CDON} ms	t_{CDOFF} ms	t_{SQ} ms	t_{STO} ms
Bell 103 Orig	25.0	0.52	9-20	4-23	-	-
Bell 103 Ans	25.0	0.52	9-20	4-23	-	-
CCITT V.21 Orig	25.0	0.52	10-20	10-20	-	-
CCITT V.21 Ans	25.0	0.52	10-20	10-20	-	-
CCITT V.23 Mode 1 8.0	8.0	0.52	3-7	3.4-11.3	9.0	8.0
CCITT V.23 Mode 2 8.0	8.0	0.52	3-7	3.4-11.3	9.0	8.0
Bell 202	8.0	0.52	3-7	3.4-11.3	9.0	8.0

Figure 4 Modem Timing Parameters